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NORTHERN TREES IN SOUTHERN LANDS

ERNEST H. WILSON

INTRODUCTION

SINCE the settling of the white man in the southern hemisphere many northern trees have been introduced there, some for their economic value and others for aesthetic purposes. Now that the world-wide shortage and consequent high price of timber has called forestry and especially afforestation into active being the value of exotic trees for practical forestry purposes is being universally appraised. Each country is requesting quick growing trees yielding useful timber. Haste is the order of the day and it is remarkable that so few southern countries where forestry has been inaugurated seem to find indigenous trees of sufficiently rapid growth. And so the exotic is in request. During my recent tour through Australasia and South Africa I found much to interest me in the behavior of our northern trees in these southern lands and it has been thought that these observations may be worth recording.

That varieties of such northern fruit trees as the Apple, Pear, Peach, Nectarine, Japanese Plum, Orange and Lemon thrive in parts of Australasia and South Africa is common knowledge. Less is known about the behavior of the ordinary northern trees planted either for ornamental or forestry purposes in the southern lands and yet several species of these trees flourish amazingly there and are already proving an immense boon to the people.

In popular language trees are commonly divided into the two classes of Hardwood and Softwood. All dicotyledonous trees are classed as Hardwood and all the gymnospermous trees as Softwood. That the terms are misleading is obvious, for the wood of many Dicotyledons is so soft as to be utterly useless as timber. However, in general the wood of the Gymnosperms is straighter of grain and more easily worked than that of Dicotyledons. In the northern hemisphere the Conifers yield nearly all the softwoods but in the southern hemisphere there is a great scarcity of this kind of timber and such as there is is yielded chiefly by the Taxads. No species of northern Conifers or Taxads is indigenous in the southern hemisphere and of these families five genera only have representatives

both north and south of the equator. Of the Conifers the genus *Libocedrus* is represented in California by *Libocedrus decurrens* Torr., in Formosa and southern China by *L. macrolepis* Benth. & Hook. f. and by six other species south of the equator of which two grow in South America, two in New Zealand, one in New Caledonia and one in New Guinea. One species (*Juniperus procera* Hochst.) of the characteristic northern genus *Juniperus* just crosses to the south of the equator on the highlands of Kenya Colony in central Africa. Of the tropical genus *Agathis* one species (*Agathis alba* Foxw.) is found in Malaya and the Philippines while the others grow south of the equator, one of these (*A. australis* Steud.) being the famous Kauri Pine indigenous in northern New Zealand. Of Taxads several species of the cosmopolitan genus *Podocarpus* are found north of the equator and two of them (*Podocarpus macrophylla* D. Don and *P. nagi* Zoll. & Moritzi) occur as far north as southern Japan. The genus *Dacrydium* belongs principally to the southern hemisphere but is represented north of the equator by the Malayan species *Dacrydium elatum* Wall. and *D. Beccarii* Parl.

FOREST WEALTH AND FOREST PROBLEMS

Before proceeding further it is advisable to say a few words about the forest wealth and forestry problems of these southern lands. Africa south of the Zambesi River is high level country except a narrow broken coastal fringe. On these highlands forests, as we understand the term, do not exist. The trees found there are low-growing with short boles and occur in open park-like formations. All are hardwoods of little value. In the broken coastal fringe in parts of Natal, Zululand and the Cape Province there are belts of dense forests where grow a variety of useful timber trees. Among them are three species of *Podocarpus* (*Podocarpus latifolia* R. Br., *P. falcata* R. Br., and *P. Henkelii* Stapf) which furnish softwoods of great value. Unfortunately these and the best of the hardwoods occur scattered through the forests and their exploitation is both wasteful and expensive. The best and most accessible of these trees have been removed. Apart from the three species of *Podocarpus* referred to the only other softwood trees are various species of *Widdringtonia* of which few grow to any size but their wood is imperishable in the ground. To meet the increasing requirements of a growing population South Africa needs trees for timber and also for shade. The imperative necessity of tree planting is now being recognized. It has been found that the indigenous trees are of very slow growth compared with certain exotic species and forestry in South Africa simply means tree-planting and the conservative exploitation of such forest remnants that exist. As will be shown later soil and climate in many parts of South Africa seem favorable to tree growth and a number of exotics flourish in a remarkable manner.

Australia is a continent in every respect and an arid central zone divides it naturally into western and eastern halves. Much of West Australia

is dry and covered with thorny scrub. The north is scarcely known and not at all so far as its forest wealth is concerned. The southwestern corner only of the vast region of Western Australia---a region one-third the size of the United States---is fairly well forested with *Eucalyptus* chief of which are Jarrah and Karri (*Eucalyptus marginata* Smith and *E. diversicolor* F. V. Muell.). There are plenty of hardwoods but no softwoods. *Callitris* and *Actinostrobus*, the only indigenous conifers, are small and commercially valueless as a source of merchantable timber. In eastern Australia climatic conditions are more varied but except in Queensland softwoods are everywhere needed. South Australia is poorly forested. Victoria and New South Wales are rich in valuable species of *Eucalyptus* and in the dry interior parts of the last-named state certain species of *Callitris* grow more or less gregariously and furnish timber very serviceable for fencing and similar purposes. Queensland, much of which is north of the tropic of Capricorn, has near the coast fine mixed forests of trees yielding timber useful for all purposes. Less settled than the other eastern states the forests of Queensland have suffered comparatively slightly and now if rightly used will be found one of her greatest assets. There are hardwoods in quantity and what is more important a considerable supply of softwoods in *Agathis* and *Araucarias*. In Queensland the chief problems of forestry center in the natural regeneration of indigenous trees and the judicious exploitation of the forest wealth. Exotic trees, except perhaps some of the more tropical species of *Pinus*, are not likely to be of importance in afforestation work. The other four states, New South Wales, Victoria, South Australia and Western Australia, are not so fortunate. For supplies of softwood timber they will have to rely upon exotic trees or continue to import it from other countries. It is true that various species of *Callitris*, a genus related to the northern *Cupressus*, are indigenous in each state but as a source of softwood timber they are negligible except perhaps in the dryer parts of New South Wales. *Eucalyptus* is as robust as it is polymorphic and furnishes timber suitable for all purposes for which hardwoods are used. It regenerates freely especially after fires though often inferior species tend to become dominant. The ideal treatment of *Eucalyptus*-forests would be clean felling and logging, followed by burning of all debris then rigid fire protection until thinning becomes necessary after which light burnings may be useful in keeping down grass and miscellaneous scrub growth. Less economical but more practical is the felling and removal of all mature and overmature trees and efficient fire protection for a second crop of trees. The real problems of forestry in these four states is concerned with the discovery of exotic trees that will provide softwood cheaply and in sufficient quantity for their needs. As will be shown later considerable progress has been made and certain species of *Pinus* especially seem to promise complete success. Tree planting will be the important task of forestry in these states and much of the land now clothed with certain species of *Eucalyptus* of scrubby growth and

little economic value will ultimately be planted with Pines and other exotic conifers.

Tasmania will have to follow on the same lines though once this little state was well off in both hard and softwoods. Her Eucalyptus though few in species yield timber of excellent quality and the Huon (*Dacrydium Franklinii* Hook. f.), King William and Red Pines (*Athrotaxis cupressoides* D. Don, *A. selaginoides* D. Don and *A. laxifolia* Hook. f.) furnish most excellent softwoods but commercially speaking these softwoods have nearly vanished and since the trees regenerate badly and grow very slowly their is little hope that they can ever again become important as a source of timber. This exotic conifers must supply. The Eucalyptus are still plentiful and Blackwood (*Acacia melanoxylon* R. Br.) is not particularly scarce, though wasteful methods of lumbering have played sad havoc with both. A few years ago Tasmania supplied the Admiralty Dock at Dover, England, with a number of piles each 100 feet long and squared 20 inches by 20 inches at each end. This is a record to be proud of and if only the people of Tasmania could be brought to a realization of the full value of their Eucalyptus this little island might again supply similar requirements. Fire protection is an urgent necessity wherever forests exist and especially is this true of the whole of Australia. Fire protection, the planting of suitable exotic conifers, and the conversion of sand-dunes, the Button-grass plains and other waste lands into productive areas by tree planting are the problems confronting the Forestry Service of Tasmania.

New Zealand, the last of the regions under review, is again different. The forests are rain-forests, the trees evergreen and Conifers and Taxads are the dominant elements. Before the country was settled by white men these forests clothed the greater part of New Zealand but forest destruction has been very great and some species of trees like the wonderful Kauri Pine (*Agathis australis* Steud.) are commercially speaking gone as a source of timber. No species of Eucalyptus is indigenous in New Zealand and her native hardwood trees in general are unimportant as a source of timber. The softwoods are not excelled by those of any other land but the supply is rapidly diminishing. The trees regenerate indifferently and their rate of growth is relatively slow assisted though it be by bacteriological root-tubercles. Conservative exploitation and protection of existing forests is essential in New Zealand. When the present remaining forests have been cut out gone forever will be the Totara (*Podocarpus totara* G. Benn.), the Matai (*P. spicata* R. Br.), the White Pine (*P. dacrydioides* A. Rich.), the Silver Pine (*Dacrydium westlandicum* T. Kirk) and the Rimu (*D. cupressinum* Soland.) which with Kauri (*Agathis australis* Steud.) are the glories of New Zealand forests. Their place will be taken by planted forests of exotic northern conifers of which Insignis and Laricio Pines and Larch are destined to be dominant features. For home-grown hardwoods New Zealand has yet to discover a suitable source of supply

for it is not at all certain that Eucalyptus will prove the solution of this problem. Other exotic hardwood trees grow so slowly that it seems doubtful if home-grown timber from this source could compete in price with that imported from other countries.

NORTHERN SOFTWOOD TREES

In Australia the most useful exotic tree from the timber point of view is undoubtedly the Insignis or Monterey Pine (*Pinus radiata* D. Don). In South Africa also it is the most valuable conifer yet introduced. Altogether, so far as the evidence goes, it rather looks as if this Pine will prove the north's greatest gift to the new forests in these parts of the world. It will surprise others no doubt as it greatly did me to find a species so rare as a wild tree and of so little value in its native land to be of such immense importance in the antipodes. The quality of all timber depends very greatly on soil and climate. In the southern hemisphere the wood of the Insignis Pine is much superior to that of the same tree growing in California, its native state. It really makes quite good deals and for rough carpentry, box-making and similar purposes it is good enough. In New Zealand I saw the interior of out-buildings which had been fitted many years before with the timber of this tree and its lasting properties were quite satisfactory.

In the lands of which I write this Pine is everywhere known as *Pinus insignis*. It does not thrive equally well in all austral countries. In South Australia and Victoria, on the Canterbury Plain of the South Island of New Zealand, round Cape Town and Grahamstown, respectively in the west and eastern parts of the Cape of Good Hope, it thrives best. There are places like Rotorua in the North Island of New Zealand and Strahan on the west coast of Tasmania where it also promises to do well. In Western Australia it grows rapidly for the first 10 years and then shows a tendency to die out. In that country it is inferior to the Cluster Pine (*P. pinaster* Ait.). In parts of New South Wales it thrives, but round Sydney, where there are plenty of good-sized trees, disease has made its appearance. In Queensland it does not grow well.

The rate of growth of this tree is phenomenal. On St. Leonard's farm, a few miles from Hanmer Springs, Canterbury, New Zealand, I saw in 1921 a grove of Insignis Pine originally planted as a broad windbreak 40 years previously. It was being felled and the trees averaged 800 board feet of timber. The usual height was about 100 feet with trunks 8 feet in girth, but some trees were as much as 115 feet tall, 11 feet in girth of trunk and yielded 1000 board feet of merchantable timber. In other parts of the Canterbury Plain, notably near Greendale, I saw other windbreaks of this tree almost, if not quite, as good as that at St. Leonard's. At Macedon, a few miles out of Melbourne in Australia there are planted woods of this Insignis Pine where the trees average 100 feet in height with fine boles. Round Ballarat, also in Victoria, it flourishes and woods

planted and owned by the City Water Board are a valuable source of revenue. In South Australia the success of this Pine is assured, indeed it has made the reputation of the Forestry Department. Seventy-three and a half acres of *Insignis* Pine, the oldest 36 and the youngest 33 years of age, were felled clean and yielded 4,117,914 superficial feet of lumber which sold at \$2.50 per 100 superficial feet and realized over \$100,000. The capital outlay per acre with compound interest at $4\frac{1}{2}$ per cent included was reckoned at \$320, the gross returns at \$1490, leaving a net profit of \$1170 per acre.

On leaving Australia it had become a settled conviction in my mind that for rate of growth in annual timber increment no planted conifer could excel *Insignis* Pine at Macedon and on the Canterbury Plains. It was left for Cape Town to shatter this conviction but with the same species of Pine. The Conservator of Forests, Charles R. Ross, took me to his forestry station at Tokai. There I saw trees 33 years old that were 138 feet tall and 10 feet in girth. Two stands of this Pine had been felled at 29 years of age and yielded respectively 7,972 and 7,721 cubic feet of timber per acre. During the war the Government sold about 160 acres of *Insignis* Pine and the sum realized was approximately \$350,000. At from 12 to 15 years of age this tree is large enough to yield boxwood; at 40 years of age a fully-stocked wood of *Insignis* Pine on good soil is estimated to yield from 10,000 to 12,000 cubic feet of timber per acre.

At the Cape and in Australia and New Zealand the wood of the *Insignis* Pine is not strong or durable in contact with the soil. But it is tough, virtually free from resin and useful for fruit-boxes; it is also good wood for match-boardings, ceilings, joinery, packing-cases and in general for purposes where strength and durability are not required. In short it yields cheaply and quickly a class of timber necessary and in great demand in all these lands. The rapid growth and usefulness of this tree is now an established fact in the antipodes. That it will not thrive in all parts of this region is absolutely certain, but that it will probably be found to flourish over wider areas than so far have been experimented with is equally certain. Over great areas in Australia and only slightly lesser ones in New Zealand and South Africa, *Insignis* Pine will yield three crops per century of merchantable timber of a class necessary for the development of the industries of these countries. Where it is found to flourish no more useful softwood tree can be planted in these southern lands. Its natural regeneration is good and New Zealand is now the main source of seed supply.

Of little merit in its native land this Pine was introduced into England in 1831-32 by David Douglas who gave it the manuscript name of *Pinus insignis*. Soon afterward further material was received and David Don described and published it in 1835 under the name of *Pinus radiata*. It is a handsome tree with dense blackish green leaves, stout branches, a broad pyramidal outline when young but ultimately with an open round-

topped crown. In England it has proved hardy only in the most favored regions but there it is the fastest growing of all the species of *Pinus*. Just when and how it was introduced into Australia I have not been able to discover but no doubt the credit belongs to one of the Botanic Gardens all of which have shown noteworthy enterprise in introducing trees, shrubs and herbs. In Newman's *Catalogue of Plants in the Royal Society's Garden*, Hobart, Tasmania, published in 1857 the tree is recorded as being in cultivation there. From Australia it was carried to New Zealand. It is in southeastern Australia and New Zealand where this tree has found itself and demonstrated its great value for forest planting. Its value to South Africa seems to have been an independent discovery. A tree was growing in the Municipal Gardens at Cape Town and J. S. Lister, then Conservator of Forests, being engaged in experimenting with all sorts of exotic trees for forest planting, determined to make a small plantation of it at Tokai. This was done in 1889 and the result as already described has astonished everyone. Quite unheralded came this Californian tree to the antipodes where it is destined to become of vastly increasing value and probably the most important softwood tree for many southern lands. The success of this tree proves two things. First, the indispensable value of botanic gardens and arboreta in every country. Secondly, that a tree of little value for its timber in one country may be of enormous value in another. A third fact which this tree clearly demonstrates may be set down, namely that no one can properly appraise the value to the world of any one species of tree. Experiment alone can prove this and even then the results are conclusive only for the district and perhaps immediate neighborhood where they are carried out.

In the Cape Province of South Africa, *Insignis* and *Pinaster* Pines thrive where a winter or all the year round rainfall obtains but are liable to disease where the rainfall is a summer one. *Insignis* but not *Pinaster* thrives under the same seasonal rains in New Zealand, Tasmania and southeastern Australia and both fail in those parts of New South Wales where a summer rainfall obtains. But in Western Australia where the rainfall is a winter one *Insignis* does not promise to be a permanent success on sandy soils whereas *Pinaster* does. On good soil, however, the story will probably prove to be different.

The Landes districts of southwestern France have abundantly demonstrated the usefulness of *Pinus pinaster* Ait. so it was natural that Governments through their advisors and foresters should early introduce this Pine for planting on sandy coastal areas in the antipodes. Its greatest success in southern lands is at Cape Town. There it has found a suitable home and is thoroughly naturalized both on the better soil of the Cape Promontory and on the sandy flats which separate Table and False Bays. It grows more slowly than *Insignis* Pine but the rate of growth exceeds what we of the North are accustomed to consider satisfactory. Around Port Elizabeth it does well and at Grahamstown the municipal plantations

of this tree on common lands are a source of revenue. At Knysna extensive plantings of Cluster Pine have been made that give every promise of complete success. This Pine has proved its usefulness and adaptability in various parts of South Africa and there is good reason to believe that it will succeed in other parts of the coastal regions where the heat is not excessive and where the rainfall is a winter or an all the year round one. In the southwest of Western Australia the Cluster Pine has been sparingly planted and it appears that on sandy soil to be superior to Insignis Pine though at first it grows more slowly. In many places in southeastern Australia and New Zealand I saw good trees of Pinaster but nothing to indicate that it is likely to become an important source of timber in these countries. In South Africa the timber of Cluster Pine is useful for flooring, rafters, joists and in general carpentry and when treated with creosote it makes good railway ties. It is too resinous for fruit-boxes but is excellent for packing cases.

The Stone or Table Pine (*P. Pinea* L.) was long ago introduced into the Cape where it flourishes and there today may be seen splendid avenues and groves and magnificent specimen trees of this remarkable Pine. It is a feature of the landscape in and round Cape Town, where it has become naturalized. At Port Elizabeth, too, it is also a success. In Australia the Stone Pine has been planted as an ornamental tree in many places but with indifferent results. At Adelaide and elsewhere I saw fair specimen trees but an avenue of this tree in the town of Parramatta in New South Wales was a deplorable sight. Round Perth in Western Australia it is a failure. At Hobart in Tasmania there are a few good trees and I saw others in various places in New Zealand but except at Cape Town and Port Elizabeth in South Africa there is nothing to indicate that this tree will be of importance in austral lands. The same is probably true of the Aleppo Pine (*P. halepensis* Mill.) which has been planted in association with Cluster Pine in South Africa and to a greater extent in Australasia. At Adelaide in particular there are large specimens of this Pine over 80 feet tall. In many places in Australasia it grows faster and attains larger dimensions than it does in its Mediterranean home but the crown is scrawny, the foliage sparse and tufted at the ends of the branchlets and the cones long retained in great numbers are unsightly. On parts of the Canterbury Plains in southern New Zealand it grows well and reproduces itself freely.

In Western Australia the most valuable Pine is *P. canariensis* Smith but although there are plenty of handsome trees from 60 to 75 feet to be seen scattered about the older townships there have been no extensive plantations of the tree yet made. It makes a stout tap-root and is in consequence difficult to transplant. Cutting the tap-root of seedlings when young may solve this difficulty but sowing in situ is the surest method where practicable. The tree is so valuable that nothing will be left undone to surmount this problem. In and near Adelaide there are

many good specimen trees and at Kuitpo, also in South Australia, I saw a fine plantation of this Pine set out by the Forestry Department. At Ballarat in Victoria it is particularly flourishing and in the park there are specimen over 75 feet tall. At Macedon it thrives well and so it does in Hobart and Launceston in Tasmania. At Sydney it is not nearly so happy and its seedlings damp off badly. The summer rainfall is evidently not to its liking any more than it is to the Stone Pine (*P. Pinea* L.). Further inland it is all right. At Orange there are good trees and on a street in Goulburn I saw a specimen over 80 feet tall and perfectly symmetrical. In South Africa it does well at the Cape with its winter rainfall and eastward as far as the rainfall is distributed throughout the year but in Natal, Zululand and elsewhere with summer rainfall prevailing it is not a success. In New Zealand it gives little promise and indeed much of the country is too cold for it yet near Nelson I saw a few good specimens. In parts of South Africa and Australasia other than those where the rainfall is a summer one the Canary Island Pine is without doubt the most valuable exotic tree of its class that can be grown. Its growth is slower than that of *Insignis* Pine but in South Africa it is faster than that of Cluster Pine. The wood is of very superior quality with a fine grain, works well and is valuable for building and general constructional purposes. I have seen no old trees nor trees taller than 90 feet. These had symmetrical crowns. The leafage is dense, rather gray-green, the leaves long, relatively stout and three in a fascicle. The seedling plants are very glaucous and on the older trees and especially at or near the base of the trunk adventitious branchlets, glaucous in color are usually to be found and are a ready means of distinguishing this species from its near relative *P. longifolia* Roxb.

The Canary Island Pine is not only one of the most useful of its genus but also one of the most ornamental and South Africa and Australia should be considered fortunate in having a climate suitable for the successful growth of this fine species. Where summer rainfall prevails in South Africa the northwest Himalayan *Pinus longifolia* Roxb., the Chir Pine, is a success. At Grahamstown there is a fine plantation of this Pine and there are good specimens in the Botanic Gardens in Maritzburg. It promises to be a success in parts of the Transvaal and inland, on the hills in Natal and in the Transkei, will probably thrive. In Australia I saw very little of this Pine though it is the only species which really flourishes at Brisbane. It was interesting to find good specimens in the Botanic Garden, Hobart, where among others there is a handsome specimen 75 feet tall and 7 feet in girth of trunk. In Hobart's interesting but unfortunately neglected garden there is a particularly fine collection of Conifers including many rare species of *Pinus* (see Wilson in *Jour. Arn. Arb.* III. 51-55 [1921]) not usually found in cultivation and many of the trees are handsome specimens superior to the others I saw in the antipodes. In New Zealand except in the north the climate is too cold for the Chir Pine. In parts of southern Queensland not too far from the sea this Pine will

probably prove of great value and the same is true for similar areas in New South Wales and possibly Victoria where the climate is sufficiently warm and the rainfall a summer or all the year round one. The Chir and Canary Island Pines may be regarded as supplementary to one another. Temperature and soil being equally favorable the former succeeds where a summer rain prevails, the other where it is a winter one. There are places enjoying an all the year round rainfall where both grow well, but the Himalayan Pine will thrive under more tropical conditions than the species from the Canary Islands. The timber of both is equally good.

At Macedon, near Melbourne, *Pinus ponderosa* Dougl. is next to Insignis Pine the most valuable species and it is equally good round Ballarat. It grows rapidly and regenerates freely and in these districts its planting will be widely extended. Just which of the many forms it is that does so well in these districts I was unable to determine but those interested would be well advised to raise plants from their own home-grown seeds. At Orange in New South Wales this Pine does well and it is probable that this will be found true for many other districts in this state, among others the temperate regions of the Kosciusko range between Tumut and Cooma. The form known as *Benthamiana* Lemm. succeeds splendidly in Hobart but the var. *Jeffreyi* Vasey and others only do moderately well. In New Zealand several hundreds of acres of *P. ponderosa* Dougl. have been planted either as pure stands or mixed with the Laricio Pine (*P. nigra* var. *Poiretiana* Schneid., but better-known as *P. laricio* Poir.) and the results in general are satisfactory. On the Canterbury Plain and in Otago where the climate is drier than the average it does remarkably well, and gives every promise of becoming a valuable tree for forest planting. In rocky places *P. ponderosa* var. *scopulorum* Engelm. does well in several places in the South Island.

In South Africa, where the testing of the various species of *Pinus* is being carried out on a larger scale and in a more thorough manner than elsewhere in the antipodes, *P. ponderosa* Dougl. is being very carefully studied. For the northern Transvaal where the elevation is considerable (6000 feet and upwards) and the rainfall a summer one the varieties *arizonica* Shaw and *macrophylla* Shaw (*P. Engelmannii* Carr.) give the best promise.

The Austrian Pine (*P. nigra* Arn.) has been very extensively planted in New Zealand, both pure and mixed with other trees, but except here and there in the drier parts of the South Island it must be considered a failure. In the Rotorua conservancy it is quite worthless. The growth is slow and stunted and disease is prevalent. The Laricio Pine on the contrary flourishes and with *P. ponderosa* Dougl. ranks after Insignis Pine as the best variety for New Zealand. This Laricio or Corsican Pine has been planted in quantity in both the North and South Islands and is nearly everywhere a success though its rate of growth is only about half that of Insignis Pine. At Hobart, Laricio does only moderately well but I should

think that it would succeed in the northwestern part of Tasmania. In parts of Victoria and in southeastern New South Wales this Pine will probably thrive but elsewhere in Australia and in South Africa there is little likelihood of it being of value for forest planting.

In New Zealand *P. muricata* D. Don, the Bishop's Pine, has been planted in considerable quantity but save as a shelter or for ornamental purposes is of no value there. At Hobart, in the Botanic Garden, there is a very fine specimen of the Bishop's Pine 60 feet tall with a trunk 9 feet in girth. I was surprised to find in New Zealand magnificent trees of the rare *Pinus Torreyana* Parry and this species evidently grows to a larger size there than it does in its home in southern California. In the Public Gardens at Christchurch there are growing several specimens well over 80 feet tall and 11 feet in girth of trunk; in the old Mason garden, near Wellington, I saw even larger trees. At Rotorua the Government has a small plantation of this Pine and it is doing extremely well. The Banksian Pine (*P. Banksiana* Lamb.) has also been planted there quite freely in places but without sufficient reason. Here and there in Australasia I saw fine specimens of the Digger Pine (*P. Sabiniana* Dougl.). The best, a tree 75 feet tall and 6 feet in girth of trunk, grows in the Botanic Garden at Hobart where there are also large trees of *Pinus Montezumae* Lamb. and of the lovely *P. patula* Schlecht. & Cham. The Scots Pine (*P. sylvestris* L.) is worthless in the antipodes and none of the Pines of eastern Asia or the colder parts of eastern North America have any value there, indeed, most of them merely linger. Many of the White and Nut Pines has been tried but only the Bhotan Pine (*P. excelsa* Wall.) gives any promise of success in Australasia. However, it is possible that in southeastern Australasia, the right conditions may yet be found for *Pinus Lambertiana* Dougl. The Macedonian *P. peuce* Griseb. I did not see but it ought to be given a trial in southeastern Australia and New Zealand. At Ballarat there are splendid trees of *P. Coulteri* D. Don and I saw other good specimens at Hobart and in the South Island of New Zealand.

Naturally with such a valuable timber producing genus as *Pinus* and one whose seeds travel well much effort has been made in the southern hemisphere to acclimatise every species obtainable. During my travels I saw plants of almost every known Pine but in Australasia save locally for ornamental purposes none other than those mentioned have proved to be of value. I cannot help thinking, however, that in the coastal parts of New South Wales and southern Queensland such species as *P. palustris* Mill., *P. taeda* L., *P. glabra* Walt., *P. caribaea* Mor., *P. echinata* Mill. and *P. occidentalis* Swartz ought to be worth a thorough trial.

At Umshalotzu, near Eshowe in Zululand, I saw plantations of *P. palustris* Mill. and *P. taeda* L. thriving amazingly, indeed, in the hot coastal regions they were growing more rapidly than any other species. In the adjacent hot parts of Natal they will probably thrive also and so, too, will *P. echinata* Mill. In the Botanic Garden, Maritzburg, there is a

fine specimen of *P. palustris* Mill. fully 60 feet tall at 40 years of age. Not far from Maritzburg I saw stands of *P. patula* Schlecht. & Cham. doing remarkably well. The Forestry Department of South Africa has shown great enterprise in securing seeds of exotic trees likely to be of value for forest planting. By an expedition to Mexico numerous species of Pines indigenous there were introduced. The expedition was entirely successful and there are growing in South Africa today nearly every known Mexican Pine. The work was commenced some fifteen years ago and the experimental plantations are now yielding important data. It has been found that these do best on the highlands of the northern Transvaal and inland in Natal and the Eastern Province where summer rainfall obtains. In the northern Transvaal *P. leiophylla* Schlecht. & Cham., *P. Montezumae* Lamb. and *P. patula* Schlecht. & Cham. are growing best, putting on an average of 3 feet of growth annually, and with the varieties *arizonica* and *macrophylla* of *P. ponderosa* Dougl., promise to be the Pines best suited for that region. Similar results I was told have been obtained in the Transkei. Other species doing well in these same places are *P. teocote* Schlecht. & Cham., *P. Lumholtzii* Rob. & Fern., *P. Lawsonii* Roehl., *P. oocarpa* Schiede, *P. pseudostrobus* Lindl. and its var. *tenuifolia* Shaw, the variety *chihuahuana* Shaw of *P. leiophylla* and such varieties of *P. Montezumae* Lamb. as *Hartwegii* Engelm. and *Lindleyana* Loud. On the slopes of the Cedarbergen range, in the Clanwilliam division, I saw plantations of these Mexican Pines. Some like *P. Lawsonii*, *P. patula* and *P. Montezumae* were growing well but in this region of winter rainfall none promise to be of so much value as *P. radiata* and *P. canariensis*. In the northern and eastern parts of South Africa the story is different—some of these Mexican Pines are likely to prove to be the most valuable species. The experiment is one of great value and the results of much importance to all interested in these little-known species.

Douglas Spruce or Oregon Pine is one of the chief timbers imported into both Australia and South Africa so it is quite natural that in these countries there should be a strong desire to grow this tree (*Pseudotsuga taxifolia* Britt.). How far this will be found practicable has yet to be demonstrated. At Macedon, near Melbourne, and near Ballarat, also in Victoria, I saw many fine specimens of Douglas Spruce 70 feet and more tall, with plenty of seedling plants growing near them. In these districts this tree will certainly succeed. On other low mountains in the southeast of Victoria I think it probable that this tree will grow and also on the middle slopes of the higher mountains in the southeastern corner of New South Wales. On Mt. Lofty, near Adelaide, I saw young plants and it is possible that it may thrive in parts of South Australia. In Western Australia, Queensland and northern New South Wales there is little likelihood of this tree thriving. In Tasmania I saw no plantation of Douglas Spruce but I believe there is a probability of it succeeding in a few districts where the rainfall is moderately good. In New Zealand it has been experimentally planted in considerable

quantity and in some places is very promising. In the Selwyn plantations on the Canterbury Plain not far from Christchurch there are large trees over 60 feet tall. The trees have grown rapidly but were placed too wide apart and are therefore much-branched. The wood is very brittle I was told. In the Government plantation at Hanmer Springs also near Christchurch, and in those round Rotorua in the North Island there are promising young stands of this conifer and the intention is to yearly increase its planting. The neighborhood of Nelson seemed to me a promising place for this tree. In fact I believe that Douglas Spruce will be found to grow well in many parts of New Zealand but whether its wood will equal that from Puget Sound time alone can prove

In South Africa the story is different. There is little hope of Douglas Spruce ever being a useful tree there for forest planting. Here and there on mountains in the southwest corner and perhaps as far east as Knysna spots may be found where this tree will grow well but the possible areas appear to be small. The more southern *Pseudotsuga macrocarpa* Mayr might prove a more adaptable tree in South Africa. On the whole Victoria and certain parts of New Zealand seem to promise best for the growing of the Douglas Spruce.

In New Zealand the Forestry Department has devoted much energy to the planting of Larch and in certain districts success seems tolerably certain. The Rotorua conservancy has more than seven thousand acres of pure stands of European *Larix decidua* Mill. In the valleys and plains it is injured by frosts but on the mountain slopes it grows splendidly and these Larch-plantations are one of the most encouraging sights an advocate of tree planting sees in New Zealand. The thinnings are used for mine props and fuel and no difficulty is found in disposing of them. In the South Island there are some three thousand acres of Government plantations and pure Larch mostly the European species. On the plains it is again not a success but succeeds on the mountain slopes. At Hanmer Springs, Canterbury, I saw over a thousand acres of pure Larch and no one could wish for better growth than this plantation showed. New Zealand is a mountainous country and it would appear that there is very much land suitable for growing Larch. The Japanese Larch (*L. Kaempferi* Sarg.) has been planted on a more limited scale. It grows more slowly than the European but it seems more drought-resistant and so far has proved immune to a disease which in places causes premature needle-shedding in *Larix decidua* Mill. Now that its requirements are understood and if full discretion is displayed it is probable that in New Zealand Larch is destined to rank with *Pinus radiata* D. Don and *P. nigra* var. *Poiretiana* Schneid. (*P. laricio* Poir.) as the most useful of exotic trees for forest planting.

Nowhere else in my travels through the southern hemisphere did I see any serious attempt to grow Larch. On the sub-alpine mountain slopes of eastern Victoria and on those in southeastern New South Wales I

should think Larch could be grown. Also in parts of western Tasmania where on the Button-grass plains the American Larix (*L. laricina* K. Koch) might possibly prove the most accommodating species. Elsewhere in Australia and in the whole of South Africa the growing of Larch is out of the question. The Chinese Golden Larch (*Pseudolarix amabilis* Rehd.) I did not see in Australasia nor South Africa, yet it is a tree which would probably thrive in the strictly temperate regions where the rainfall is evenly distributed through the year or is a summer one.

There seems little chance that Spruce can thrive in South Africa or in Australasia. Many species have been tried but only the Himalayan *Picea Smithiana* Boiss. gives any promise of growing freely. In several places notably the Botanic Gardens at Hobart and on a private estate near Christchurch in New Zealand, I saw fine individual trees of this species. In the Botanic Garden at Grahamstown in South Africa also it does fairly well while in the Botanic Garden in Maritzburg it may be said to flourish. It is possible that places may be found where this Spruce will be a success for forest planting. The Sitka Spruce (*P. sitchensis* Carr.) is the species that the foresters in the antipodes would most like to succeed with. I saw large trees near Ballarat and at Macedon in Victoria and likewise on a private estate near Nelson in New Zealand but they were planted far apart and heavily branched. Red spider seems particularly fond of this tree in southern lands and it is doubtful if it will ever be of importance there. In New Zealand especially many other species of *Picea* have been planted but none promise to be of value except an odd tree here and there as ornamentals. Yet one would think that on the cold sub-alpine mountain slopes of southern New Zealand and on the Button-grass plains of northwest Tasmania either the Red Spruce (*P. rubra* Link) or the Norway Spruce (*P. Abies* Karst.) or both would be found to thrive. At any rate in these places they are worth a proper trial. In South Africa and Australia, however, I do not think any of the Spruces will be of any considerable value for forest planting.

What is said of *Picea* applies equally to *Abies*. The only species I saw doing well in many places in Australasia was *Abies pinsapo* Boiss. Fine trees of the Spanish Fir are to be seen, notably in Hobart, and if the wood has any value plantations might be made in a number of places. Another species of which I saw good specimens is *A. Nordmanniana* Spach. On Mt. Lofty near Adelaide at Ballarat and Macedon in Victoria at Wellington and near Christchurch in New Zealand there are fine specimens of this Fir. At Hobart there are healthy young trees of *A. pindrow* Spach. In a fine old garden, the Mason Garden at Taita just outside Wellington, New Zealand, now neglected and doomed, there is a fine collection of plants including thickets of huge Himalayan Rhododendrons, a magnificent *Magnolia Campbellii* Hook. f. and many notable conifers, including the Firs named above and also *A. nobilis* Lindl., *A. alba* Mill. (*A. pectinata* DC.), *A. spectabilis* Spach (*A. Webbiana* Lindl.) and *A. venusta* C. Koch

(*A. bracteata* Nutt.). The late T. W. Adams, Greendale, Canterbury, who did much useful pioneer work in experimental tree planting in southern New Zealand, has left it on record that *A. Nordmanniana* Spach, *A. alba* Mill., *A. pinsapo* Boiss. should be largely grown and that *A. concolor* Lindl. and its Californian form, *A. grandis* Lindl. and *A. cephalonica* Loud. gave promise of success. I should think the Algerian Fir (*A. numidica* De Lannoy) would be likely to succeed. For ornamental purposes Firs may be grown here and there in the cooler parts of Australasia but for forest planting there I do not think they have any future. Neither have they in South Africa though near Cape Town I saw good specimens of *A. pinsapo* Boiss.

The Hemlocks are another group of Conifers of no promise in the antipodes. In the old Mason garden near Wellington, New Zealand, I saw fair specimens of the western *Tsuga heterophylla* Sarg. and *T. Merteniana* Sarg. and, at Queenstown on Lake Wakatipu in the South Island a good tree of the Himalayan *T. Brunoniana* Carr. Of the Japanese and eastern North American species I saw no trees worthy of comment.

In the Botanic Gardens, Sydney, and in the nursery grounds belonging to the Forestry Department at Gosford, much to my surprise I saw trees of *Keteleeria Fortunei* Carr. They were of no size but were fruiting and had evidently grown slowly and the species is evidently of no value in forestry. It occurred to me that *K. Davidiana* Beiss. from Formosa and western China might succeed. This is a large tree which furnishes good timber and thrives under conditions too arid and too warm for either Spruce or Fir its close relatives.

In the Botanic Gardens, Sydney, there are large handsome trees of *Taxodium distichum* Rich. and *T. mucronatum* Ten., the Swamp Cypress, those of the Mexican species being particularly noteworthy. At Melbourne there are also good trees. In the Municipal Gardens, Cape Town grow large trees of the typical *T. distichum* Rich. and of the var. *imbricarium* Sarg. with acicular leaves. It is evident that these trees are suited to certain parts of both continents. The Forestry Department of South Africa are intent on testing these trees and Australia might well do likewise.

In southeastern Australia the Redwood (*Sequoia sempervirens* Endl.) has been planted in many places for ornamental purposes but I saw none that looked really thrifty. The growth is slow the branches sparse and the trees of untidy appearance. In New Zealand I saw better trees but was nowhere favorably impressed with the suitability of this tree for forest planting. The Big Tree (*Sequoia gigantea* DC.) on the other hand grows rapidly when the soil is good. At Macedon there are some truly gigantic trees of this noble conifer. At Ballarat also there are fine specimens; likewise in private gardens on Mt. Lofty near Adelaide and elsewhere in South Australia. At Hobart, Launceston and other places in Tasmania, the Mammoth Tree flourishes exceedingly whereas its relative the Redwood

merely exists. In New Zealand especially in the vicinity of Christchurch and Nelson I saw fine trees. At Hanmer Springs, Canterbury, the Forestry Department have about five acres of this tree planted pure and doing well. Given deep soil there is no doubt this tree can be grown to perfection in many of the cooler parts of Australasia though I do not think it will be valued other than for ornament. It is a fine avenue tree where it thrives. In Western Australia it is of no value. For South Africa neither the Redwood nor Mammoth Tree are likely to be of service for forest planting. Of the Redwood I made no note of any particularly good specimen but of the other I saw fine trees in cities so far apart as Pretoria, Maritzburg, Grahamstown and Cape Town. The Chinese *Cunninghamia lanceolata* Hook. is a failure in the antipodes and the same is true of the Japanese *Cryptomeria japonica* D. Don, though in New Zealand I saw a few good plants of the variety *elegans* Mast. The wet climate of New Zealand one would think would suit this tree but though it has been tried in many places it has not been a success. For no apparent reason many trees refuse to become acclimated in foreign lands. The *Cryptomeria* is one of these and the only place in the world outside of Japan that I have seen this tree really flourishing is Darjeeling and its vicinity in north India.

In many parts of eastern Australia, in New Zealand and Tasmania, the species of *Cedrus* do well. In South Australia and Victoria in particular they grow fast. At Ballarat *Cedrus deodara* Loud. is particularly noteworthy and scarcely less so is *C. libani* Loud. At Macedon these and *C. atlantica* Manetti all do equally well while at Hobart the Atlas Cedar is best, and is used as an avenue and memorial tree. On the Canterbury Plain round Christchurch in New Zealand the Deodar is perhaps the most successful but the Atlas Cedar also does well. At Wellington both flourish and grow much faster than the Lebanon Cedar. There are of course no noteworthy specimens such as the Cedars of Lebanon England can boast but there is ample evidence that these Cedars are suited to the climate of many parts of Australasia except Western Australia. As ornaments they have proved their value in many places and the Deodar at least is worth a trial for forest planting where summer and all the year round rains prevail. It is being tried in a few places in South Africa but the experiments need to be conducted over a greater period of time before conclusive data can be obtained. In and near Cape Town and other large cities in South Africa there are good specimen trees of all three species of *Cedrus* showing that they will grow in this subcontinent.

A group of northern trees which does well in many parts of Australasia and South Africa is *Cupressus*. Many species are grown in these lands but unfortunately their identity is much confused. I believe that most of the known species have been introduced but their nomenclature is in dreadful confusion and in the absence of authentic specimens in the southern hemisphere it is impossible for those living there and interested in these trees to correctly name them. A good illustrated monograph of

this genus is much needed. I collected herbarium material in different places but have not yet had time to examine it. Five species I know sufficiently well to be sure of their identity but the others I shall mention under the names they are known by in particular localities. The most widely grown is the Monterey Cypress (*Cupressus macrocarpa* Hartw.). In Australia it is very generally known as the "Macrocarpa" tree without any generic name. In Kenya Colony in equatorial Africa the name is changed to "Microcarpa." The general application of the specific name either rightly or wrongly rendered as a vernacular name is proof of the popularity of this tree. It is as a hedge plant that it is most widely employed but as an ornamental tree it has been planted in great numbers. Though it does not thrive everywhere in the antipodes it succeeds throughout a greater area than almost any other exotic tree. In Western Australia it has a bad habit of dying suddenly and hedges of it are often patchy as blocks of it die in the hedgerow. On this account it is losing popularity in that state. In eastern Australia it flourishes and is a most popular hedge plant. It is also much planted in New Zealand and South Africa. I saw many fine specimen trees in the antipodes, the grandest I think are growing in the grounds round the Salmon ponds, New Norfolk, Tasmania. They are not much more than fifty years old and are fully 80 feet tall and 12 feet in girth of trunk. For forest planting the *Cupressus* as yet have scarcely been employed but the fact that their wood is very lasting in the ground and therefore most suitable for fencing makes them valuable. I saw one or two small experimental stands and the rate of growth was quite satisfactory. At Tokai, near Cape Town, there are small stands of several species but the names are confused. The Mediterranean species (*C. sempervirens* L.) and its fastigiate form *stricta* Ait. have been much planted as ornamental trees and in general does well in many places in eastern Australia and South Africa. In the vicinity of Adelaide they are notably successful, also at Hobart. For forest planting in South Africa and eastern Australia, the Nepal Cypress (*C. torulosa* D. Don) and the so-called Portugal Cypress (*C. lusitanica* Mill.) promise most. At Salisbury in Rhodesia these are the only two exotic conifers that really thrive and the Nepal Cypress grows faster and better. At Maritzburg both do well and the same is true at the Cape though there the Portugal Cypress is the more common. In New Zealand, South Australia and in Victoria I saw many good trees of both species and at Hobart *C. torulosa* D. Don is particularly good. Here and there in eastern Australia I saw fine specimen trees of the Chinese *C. funebris* Endl. but I do not think it has value there for forest planting. The same is true in South Africa. In several places in eastern Australia I saw nice trees of a Cypress known as *C. Lindleyi*. It has bluish green foliage, hanging branchlets and small fruit. At Nairobi in Kenya Colony, almost on the Equator in central Africa, a species of Cypress from Guatemala thrives better than any other exotic conifer and will certainly prove a useful subject. Trees under the names of *C. Goveniana*

C. Macnabiana, *C. Benthamii*, *C. Knightiana*, *C. glabra*, and *C. arizonica* are growing in South Africa and Australasia but how far these names are correct I am not yet in a position to determine. As a group, *Cupressus* is a success in many parts of the southern hemisphere visited by me and they have a decided future not only as ornamental trees but as trees for forest planting, but before this can be properly embarked upon their nomenclature must be straightened out since all species do not thrive equally well. As with other trees some are better suited to certain localities than others but since different species are in different places known under the same name it is impossible to say much about the behavior of the different species.

The *Chamaecyparis* do not promise to succeed though *Chamaecyparis Lawsoniana* Parl. has been much planted in New Zealand, Victoria and elsewhere but almost exclusively as an ornamental tree. Occasionally good specimens are seen as on Mt. Lofty near Adelaide and the same is true of *C. nootkatensis* Sudw. The Japanese species are a failure except here and in gardens yet in Natal I think that the Formosan *C. formosensis* Matsum. should be given a good trial. In the old Mason garden near Wellington there are fine old trees of *Libocedrus decurrens* Torr. but I saw none of special merit elsewhere. In New Zealand a few small plantations of *Thuja plicata* D. Don under the name of *T. gigantea* have been made but their rate of growth is very ordinary and there is nothing to indicate that this tree will be of value there or elsewhere in Australasia. In fact apart from *Cupressus* none of the exotic *Cupressineae* give promise of being important as a source of timber though several are useful ornamental trees in the southern hemisphere.

Several species of *Juniper* were long ago introduced into the southern hemisphere as ornamental trees. Recently attention has been drawn to them as possible supplies of wood for pencil making but it seems doubtful if they will be of use for this purpose in the antipodes. A number of the tree species grow very well but the rate of growth is not rapid. If any species is likely to be of value I should think it would be the gigantic *Juniperus procera* Hochst. so important a tree on the highlands of Kenya Colony, equatorial Africa, and north to the mountains of Abyssinia. The largest *Junipers* I saw were of the Bermuda species (*J. barbadensis* L.) in the town of Maritzburg, Natal. They grow on some church property and the trees are fully 60 feet tall and 8 feet in girth of trunk. I saw this tree in several other places in South Africa and also in eastern Australia but though many were nice specimens they were inferior in size to those in Maritzburg. In eastern Australia and Tasmania I saw good trees of *J. excelsa* Bieb. and this with the Bermuda *Juniper* appear to grow better than others. Both *J. virginiana* L. and *J. chinensis* L. have been planted but neither are any great success though the American species does fairly well on parts of the Canterbury Plain, New Zealand. At Hobart there are shapely trees of *J. drupacea* Labill. and in the various Botanic Gardens

of eastern Australia I saw healthy young trees of *J. Cedrus* Webb & Berth. native of the Canary Islands. The best of all species for pencil cedar-wood (*J. lucayana* Britt.) I did not see anywhere in the antipodes nor such fine species as *J. mexicana* Spreng., *J. occidentalis* Hook. and *J. monosperma* Sarg. These I should think worth a trial. They are certainly ornamental trees and so, too, is the Checkered-bark Juniper (*J. pachyphlœa* Torr.) which is occasionally grown in the gardens of southeastern Australia. The Japanese *J. procumbens* S. & Z. does well in gardens in southeastern Australia and New Zealand and is in fact a greater success than any other Japanese conifer. In many places red spider plays havoc with Junipers and nowhere in the antipodes do they seem to grow rapidly. The wood lasts indefinitely in the ground but so does that of the Cupressus and the Australian Callitris and it would appear to me that these trees are better suited to the climates of Australia and South Africa.

NORTHERN HARDWOOD TREES

A large number of species of northern broad-leaf trees have been planted in Australasia and South Africa but with few exceptions they are not a success. For forest planting none are of outstanding promise and in South Africa and Australia south of the tropic the Eucalyptus is the hardwood tree par excellence. In fact it seems probable that the genus is destined to supply the greater part of the world's future needs of hardwood timber. A few kinds of wood used for special purposes will always have their own market but for general construction purposes Eucalyptus-timber will become more and more important. In South Africa they grow 10 feet a year and out of the great number of species there are some suited to all climates from temperate to tropical. I very much fear that our northern trees, neither at home nor abroad, will be able to compete with these lusty, vigorous southerners in the field of commercial forestry. In New Zealand but a few species of Eucalyptus grow well and these only in limited areas but even there they do better than any of our northern broad-leaf timber trees.

The common European Oak (*Quercus robur* L.) has been extensively planted in Australasia and South Africa and in general one must suppose that sentiment rather than business acumen is responsible for this. Those who have given any attention to the matter have realized that this Oak is not suited to the prevailing climatic conditions and yet sentiment, and to this may be added ignorance and enthusiasm, still causes these trees to be planted in quantity. Memorial trees to those who fell in the Great War have been planted in many lands—a commendable thing to do in any country—but if the memorial is to be worthy and lasting, and such its promoters fully intend it to be, the planting of trees suitable to the country is of fundamental importance. This has rarely happened where the white man rules. At Perth, the capital city of Western Australia, in King's Park an effort to plant a long avenue of such trees has been made

and in every instance the trees are of exotic origin and the probability of any of them growing into specimens of even moderate size is very remote. The common European Oak figures prominently in this avenue but is fore-doomed. In southeastern Australia this Oak has been much planted for ornamental purposes in parks, gardens and streets. A few good specimens may be seen, notably in Melbourne, but these are the exception and the usual trees are stunted in growth and liable to disease. A scale insect is a great scourge killing the trees outright in three years I was told. In Tasmania the same is true except that the scale pest is only just beginning its devastations there. In New Zealand, especially the South Island, many plantations of *Quercus robur* either pure or mixed with other northern broad-leaf trees or with Pines have been made but as a source of merchantable timber are an obvious failure. In many places it grows rapidly at first but after a few years becomes almost stationary. In South Africa as far north as Pretoria the Oak has been planted. Around Cape Town, there are quite extensive groves and the acorns are a marketable commodity as feed for pigs. In some of the suburbs of Cape Town there are large trees and the town of Stellenbosch, thirty-one miles from Cape Town and the second oldest settlement in South Africa, is famous for its Oaks. This town was founded by Simon van der Stel in 1680 and the Oaks were planted by his order soon afterward. Francis Masson, the first plant collector sent out from Kew, visited Stellenbosch in December, 1772, and commented on the row of fine Oaks on either side of the solitary street. In 1922 I found that Stellenbosch now boasted more than a solitary street and that the Oaks are still in excellent health and a credit to the town. The largest trees are less than a hundred feet tall and about ten feet in girth of trunk. The climate evidently suits them but considering their age, well over two hundred years, their size cannot be considered remarkable. Both in South Africa and Australia for forest planting it is folly to plant this Oak since *Eucalyptus* yielding a timber equally useful, will attain the dimensions of the famous Stellenbosch Oaks in twenty-five years. In the South Island of New Zealand where *Eucalyptus* is scarcely happy there is good excuse for experimenting with the Oak but I saw nothing to warrant optimism about it.

The Turkey Oak (*Q. Cerris* L.) is better suited to the climates of South Africa and southeastern Australasia but is very little grown, and its wood is of inferior quality. In the Melbourne Botanic Gardens there is quite a good collection of species of Oaks. It includes a number of American species and I noted fair trees of Swamp White Oak (*Q. bicolor* Willd.), Red Oak (*Q. borealis* var. *maxima* Ashe), Scarlet Oak (*Q. coccinea* Muench.), Black Oak (*Q. velutina* Lam.), Pin Oak (*Q. palustris* Muench.), White Oak (*Q. alba* L.) and others including the Bur Oak (*Q. macrocarpa* Mich.). On the whole they were a creditable lot of trees and the presence of healthy specimens of the White Oak surprised me but there was nothing to indicate that they have value as trees for forest planting. At Hobart I saw good

trees of the Red Oak. The Spanish and north African *Q. Mirbeckii* Durieu, which often goes by the mysterious name of "*Q. Hodgkinsonii*," and the related *Q. lusitanica* Lam. do quite well round Adelaide, Melbourne and even Sydney and on the Canterbury Plains in New Zealand. The Oaks of Japan and China do not flourish and even the widely distributed *Q. variabilis* Bl. and *Q. serrata* Thunb. are stunted and worthless. The evergreen Oaks do better in the southern hemisphere than the deciduous leaved species. Such species as the Holm Oak (*Q. Ilex* L.) the American Live Oak (*Q. virginiana* Mill.) and the Himalayan *Q. incana* Roxb. do really well and could be used for shade and avenue trees to advantage in many places. Just outside Cape Town I saw very large trees of the Cork Oak (*Q. suber* L.) and this species seems perfectly happy there. At Hobart and other places in southeastern Australia I saw nice specimens of the Cork Oak but all mere pygmies compared with the giants at the Cape. For ornamental purposes I should think that *Q. lobata* Née, *Q. agrifolia* Née and other species indigenous in California and also those of Mexico would be worth a trial in South Africa and southeastern Australia.

The handsomest and most flourishing northern tree in southeastern Australia is *Salix babylonica* L. The finest specimens in all the world of this tree are surely there and thousands of them. Anywhere alongside of water from Adelaide east to the Pacific and north to beyond Sydney it is a thing of beauty. On the upper reaches of the Murrumbidgee, round Tumut, I saw many notable specimens. Not only is this tree beautiful but it is also very useful, affording welcome shade to man and beast and in times of drought its leafy branches are greedily eaten by stock of all kinds. In Tasmania, notably at New Norfolk on the banks of the river Derwent, this Willow is perfectly at home. In New Zealand it is not so great a success and is much less plentiful, one reason being that the climate of most of the South Island is really too cold. In South Africa the Weeping Willow does almost as well as in southeastern Australia though it has not been planted in such quantities. Popular belief in Australia has it that all the older trees came as cuttings from Napoleon's Willow at St. Helena. This island was formerly an important port of call on the voyage from and to Europe and so the lovely Babylon Willows of Australasia may be descended from those earlier introduced into St. Helena.

In the South Island of New Zealand the White Willow (*Salix alba* L.) and the Crack Willow (*S. fragilis* L.) are of immense importance in keeping the rivers within bounds. For this purpose they have been planted in vast quantities along the river margins and are as much at home as if native of the country. The common Hawthorns of Europe (*Crataegus Oxyacantha* L. and *C. monogyna* Jacq.) are the hedge plants of this same part of New Zealand. Many hundreds of miles of hedges are made solely of these Thorns. Nothing could serve the purpose better or be more amendable but as the host of Fire-blight they have become a menace in the Apple growing regions. To the sheep and cattle farmers these thorn

hedges are indispensable and the interests of these farmers are of greater value to the country than those of the Apple-grower who would much like to have all the thorn hedges destroyed. In Tasmania these European Thorns also flourish and at Hobart I noted nice trees of the black fruited *C. Douglasii* Lindl. of western North America and the Washington Thorn (*C. phaenopyrum* Med.) with its cheery scarlet fruit. The common European Alder (*Alnus glutinosa* Gaertn.) has been largely planted in New Zealand and in wet places does well. There seems to be a particular reason for planting this tree and if timber is the object it would be better to plant *Alnus japonica* S. & Z. which grows rapidly to a large size. On the pumice and volcanic ash of the Rotorua region and elsewhere in New Zealand *A. firma* S. & Z. ought to be a useful tree since it is at home under such conditions in Japan.

A few years ago *Catalpa speciosa* Engelm. was boomed for forest planting. In New Zealand alone millions of these trees were planted but few survive and none show any promise of growing into timber producing size. In eastern Australia the experiment was also tried in places on quite a large scale, but the results proved equally barren and disappointing. In these same countries the Black Locust (*Robinia Pseudoacacia* L.) has also been planted on a considerable scale but it grows slowly and does not promise to be of economic value. But a South American tree, *Schinus Molle* L. (the Pepper Tree of California) has proved of much value both in South Africa and Australia. In the dry interior regions of both lands it is a veritable Godsend as a source of shade. At Kalgoorlie on the gold-fields of Western Australia it is almost the only tree that can be grown there. For towns and homesteads situated in arid places its planting cannot be too strongly encouraged; but it should be more or less restricted to such regions and not planted promiscuously over the whole country as is now done. At Adelaide grow the largest Pepper-trees I have seen and in the relatively dry climate little can be urged against its presence but in wetter climates it ought not to be grown. Its fruit has a deleterious effect on chickens and some contend that its mere presence militates against the health of poultry.

The London Plane (*Platanus acerifolia* Willd.) has of course been carried to the southern hemisphere for street and avenue planting. Where summer rains prevail it is often a success, in some places notably so, in others it fails. Where winter is the season of rains it cannot be recommended. The finest avenues and groves of this tree I saw in Australia are in Adelaide and Ballarat. They are very fine in Melbourne also. In these places the tree grows rapidly, is free of disease, gives an abundant of much needed shade and can be highly recommended for park planting especially. In certain places in the South Island, New Zealand, the London Plane does moderately well but it is not so happy as in Victoria and South Australia. In Western Australia, Queensland and much of New South Wales it is worthless or virtually so. As a street tree in Pretoria, in the

Transvaal and in some other places in South Africa this Plane-tree is a success. At Maritzburg in Natal, it flourishes and in the Botanic Garden there it makes a fine avenue. At Pretoria *P. Wrightii* S. Wats., native of Arizona and New Mexico, is planted as a street tree and grows well though it is inferior for this purpose to the London Plane on account of the narrower acute lobes in the leaves which are inclined to droop and furnish less shade. The presence of this unusual tree was a great surprise and I could scarcely believe it was the true *P. Wrightii* S. Wats. I have since compared specimens from Pretoria with authentically named material in the herbarium of the Arnold Arboretum and its identity is certain. Evidently this western Plane finds the climate of Pretoria to its liking though as the trees are all young and now not more than twenty-five feet tall it is too early to judge of its permanent value.

The Maples thrive indifferently in Australasia and the Lindens, Horsechestnuts and Chestnuts not at all. Here and there the English Elm (*Ulmus procera* Salisb.) luxuriates. Round the race course at Tumut in New South Wales there are some exceptionally fine trees of this Elm. At least I believe them to be this species though their habit of growth recalled the American White Elm (*Ulmus americana* L.) At Ballarat in Victoria a memorial avenue some two miles long to the soldiers who took part in the Great War is of Elm-trees. I hope that they will flourish but am not sanguine about them.

Various species of Ash have been planted in some quantity in south-eastern Australia and New Zealand and here and there they grow very well. The European *Fraxinus excelsior* L. and the American *F. americana* L. do equally well where the soil is deep and good. At Campbelltown near Sydney and again at Greendale on the Canterbury Plain I saw *F. oregona* Nutt. growing freely. At Adelaide grow many Ash-trees including quite a good avenue of *F. chinensis* Roxb. in which the trees are taller and of greater girth than I have seen this tree elsewhere including its native country China. In the southern parts of New Zealand it is possible, though I scarcely think probable, that Ash may be useful in forest planting as a source of timber but in Australia and Tasmania it cannot compete with certain species of Eucalyptus (*Eucalyptus gigantea* Dehnh. and *E. obliqua* L'Hérit. for example) which yield wood of very similar character.

The Birches are not a success in Australasia though in New Zealand the European *Betula pendula* Roth has been much planted in mixed stands with other exotic trees. Of Beech I saw a few healthy trees of *Fagus sylvatica* L. on a private estate, Stoke, just outside Nelson in New Zealand but have no other record of meeting with it on my travels through Australasia. The Black Walnut (*Juglans nigra* L.) does not thrive in these southern countries but at Gosford not many miles from Sydney, New South Wales, I saw several species of Hickory doing well. The man in charge claimed to have no difficulty in transplanting them, his method being to sever the tap root with a sharp knife and sear it with a hot iron.

I quote his method without endorsing its efficacy except to state that he succeeded in the difficult task of transplanting these trees. I firmly believe that in rich alluvial soils in southeastern Australia the Pecan (*Carya pecan* Asch. & Graeb.) and other valuable species will someday be grown in quantity. There are also places in South Africa where these trees would grow well. In the Botanic Gardens, Maritzburg, Natal, several species flourish and one tree of *C. pecan* is fully 75 feet tall and 5 feet in girth of trunk. As a source of timber I see no future for Hickory in the southern Hemisphere but those species, varieties and hybrids which bear nuts good to eat will someday be successfully grown in these lands.

The Tulip-tree (*Liriodendron Tulipifera* L.) and the Sweet Gum (*Liquidambar Styraciflua* L.) grow well in many places in South Africa, southeastern Australia and New Zealand but they require deep soil. It would be rash to prophecy the value in forest planting of these trees but that they will grow in favorable places is proved. The best Tulip-trees I saw on my travels are growing in the Botanic Garden, Maritzburg, Natal, where there are specimens 80 feet tall and 7 feet in girth of trunk at 41 years of age. Another American tree, the noble *Magnolia grandiflora* L. thrives in many parts of the southern hemisphere visited by me. In the various Botanic Gardens and on many private estates I saw very fine trees. With its large, glossy green leaves and handsome flowers this *Magnolia* has few equals as an ornamental tree where climate suits it. Except in a few gardens in New Zealand, like the old Mason garden near Wellington, the Asiatic *Magnolias* are not a success in Australasia.

The Pride of India or Persian Lilac (*Melia Azedarach* L.) has been overplanted in Australasia and South Africa as elsewhere in the warmer parts of the world. One seldom sees a good tree and though undeniably pretty in blossom it is not a thing of beauty for much of the year. In South Africa for some unknown reason it goes by the name of "Syringa." It is a fast growing tree which seeds freely and is apt to become a weed in places where it flourishes. The Tree of Heaven (*Ailanthus altissima* Swingle) does well in regions of summer and all the year round rainfall though it is not so common as one would have thought. There are very good trees in and round Adelaide, South Australia. Gardens of the same city and also of Melbourne and elsewhere in Victoria boast many nice trees of *Cercis Siliquastrum* L., the Judas-tree, The Olive (*Olea europaea* L.) grows well in many parts of Australia and South Africa but the fruit is very inferior.

The Camphor (*Cinnamomum Camphora* Nees & Eberm.) has been much planted in southern lands and grows well in a variety of climates. As a shade tree it is much to be recommended but I heard of no camphor having been extracted from it neither do I think there is any likelihood of such a thing taking place on a commercial scale anywhere in the antipodes. For forest planting I see no future for the Camphor-tree but for ornamental purposes, either as specimens or for avenues and as a street tree it is likely

to prove on account of its adaptability one of the most useful broad-leaf evergreen trees introduced into the southern hemisphere. Another evergreen tree which does well in the regions of which I write is *Ligustrum lucidum* Ait. In the city of Pretoria in the Transvaal this Privet is used as a street tree and to good effect. Trained to a single stem and its crown kept within bounds by judicious pruning it is ideal for city squares and streets where small trees are in request.

In many parts of southeastern Australia the Osage Orange (*Maclura pomifera* Schneid.) has been planted chiefly for hedges and around Tumut in New South Wales I saw large trees. In the drier and interior parts of Australia I should think the Mesquite (*Prosopis juliflora* DC.) and its varieties *glandulosa* Cock. and *velutina* Sarg.) well worth planting. As food for stock they are of great value in Texas and elsewhere in this country and there is no reason why they should not be equally valuable in Australia. Their wood is almost indestructible in contact with the soil and is most serviceable for fencing purposes, railway ties and the underpinnings of buildings; the ripe pods supply Mexicans and Indians as well as cattle with a nutritious food.

Of the famous Dragon-tree of Teneriffe (*Dracaena draco* L.) there are plenty of large trees in Australia and South Africa where it is evidently favored. That fine Palm, *Phoenix canariensis* Chabaud, is quite at home in eastern Australia where in Sydney and elsewhere many fine specimens are to be seen. The same is true of the Fan Palm (*Washingtonia filamentosa* O. Kuntze) native of the dry parts of southern California and adjacent regions. Speaking of Palms, though not a northern species *Jubaea spectabilis* H. B. & K., the Coquito Palm of Chili, is worthy of mention since so many magnificent specimens of it grow in Australia, those in the Adelaide Botanic Gardens being exceptionally fine. Another South American tree much used in South Africa and eastern Australia in gardens and for street planting is *Jacaranda mimosifolia* D. Don. With its finely divided leaves and large erect panicles of violet-blue Foxglove-like flowers this must be counted one of the world's most pleasing small trees. In eastern Australia this *Jacaranda* is hardy as far south as Adelaide and flourishes northward to Brisbane. In South Africa it is a feature of the streets of Pretoria.

Suitable wood for match splints is a desideratum in Australasia and South Africa. Poplars are being experimented with as a source of supply. In South Africa *P. canescens* Smith has been much planted and is naturalized in places so far apart as Pretoria and Cape Town. At Johannesburg and elsewhere I saw plantations of this tree. In Cape Town and the neighborhood there are many large trees of the Gray Poplar. The wood is being used for match splints and is at present the main source of supply. The so-called *P. monilifera* Ait. under the name of *P. deltoidea* var. *missouriensis* (the correct name of which is *P. balsamifera* var. *virginiana* Sarg.) is being experimented with and promises to grow rapidly in South Africa

and also in the South Island of New Zealand. In the latter country *P. alba* var. *pyramidalis* Bge. (*P. Bolleana* Lauche) does very well and ought to be given a good trial in South Africa, and so, too, should the Carolina Poplar of American nurseries, a supposed hybrid between *P. balsamifera* L. and the Lombardy Poplar and named *P. canadensis* var. *Eugenei* Schelle. The Lombardy Poplar (*P. nigra* var. *italica* Dur.) is, of course, planted in many places and thrives in not a few but its use is mainly as a wind-break. The White Poplar (*P. alba* L.) from some reason or other appears to be rare, at least in the parts of the southern hemisphere visited by me. There is little hope of the Aspens (*P. tremula* L. and *P. tremuloides* Michx.) being successfully grown, much less naturalized, in the antipodes except possibly on the mountains in southern New Zealand. The north China *P. tomentosa* Carr. is a species worthy of trial in South Africa and New Zealand and one would think that the species from the dry sunny regions of southwestern North America were worth experimenting with especially in South Africa. For example such species as *P. arizonica* Sarg., *P. texana* Sarg., *P. Fremontii* S. Wats. and *P. McDougallii* Rose ought certainly to be given a good trial.

What I have written does not pretend to exhaust the list of Soft and Hardwood northern trees introduced into Australasia and South Africa though no tree of proved importance has been omitted. If the home of these trees be inquired into it will be seen that it is the trees of western North America from central California southward including Mexico, those of the Mediterranean region including the Levant and those of the north-west Himalayas that grow best in the southern lands under review. The trees of China and Japan, with the exception of the Babylon Willow (*Salix babylonica* L.) and the Camphor-tree (*Cinnamomum Camphora* Nees & Eberm.), those of northern Europe, except the Larch (*Larix decidua* Mill.) and White Willow (*S. alba* L.) in New Zealand and *Quercus robur* L. at the Cape of Good Hope, and those of eastern North America, except the Tulip-tree (*Liriodendron Tulipifera* L.) and Sweet Gum (*Liquidambar Styraciflua* L.), grow badly and give little promise of success. The trees of southeastern United States, especially certain species of *Pinus*, ought to be given a fuller trial, for very possibly they like their fellow countrymen, the Swamp Cypress (*Taxodium distichum* Rich.) and the Bull Bay (*Magnolia grandiflora* L.), will be found to thrive where climate, soil and rainfall are favorable. It is only by experimental planting that the value of any tree can be determined. As far as my observations go and granted that the minimum temperature is not too low, the only point of practical importance to be kept in view in the planting of exotic trees is that of the season of rainfall. In lands of marked wet and dry seasons it does make an enormous difference in the behavior of tree-growth whether the wet season is that of winter or of summer. Where rainfall is sufficient the chemical properties of soils appear to be of much less importance than their physical character. As proof of this I may instance *Pinus radiata* D.

Don and *P. nigra* var. *Poiretiana* Schneid. which in New Zealand thrive equally well on the poor volcanic soils of Rotorua and the rich alluvial soils of the Canterbury Plain. There are, of course, minimum and maximum temperatures below and above which no species of tree will flourish but with few exceptions excess of heat is better withstood than that of cold.

From the point of view of timber the Long-leaf or Southern Pine (*P. palustris* Mill.) is the finest species of *Pinus* in the world. In the coastal regions of Natal and those of New South Wales and Queensland where a summer rainfall prevails this species, together with *P. taeda* L., *P. caribaea* Morelet, *P. glabra* Walt., *P. occidentalis* Swartz and *P. echinata* Mill., ought to be given a thorough trial.

Tabulated the Softwood northern trees of proved or probable value for forest planting in Australasia and South Africa are:—

Western Australia

- Pinus canariensis*
- Pinus pinaster*
- Pinus radiata* (in good soil)
- Cupressus lusitanica* (in good soil)

South Australia

- Pinus radiata*
- Pinus pinaster*
- Pinus canariensis*
- Taxodium distichum*

Victoria

- Pinus radiata*
- Pinus ponderosa*
- Pseudotsuga taxifolia*
- Cedrus deodara*
- Cedrus atlantica*
- Taxodium distichum*
- Cupressus macrocarpa*
- Cupressus torulosa*

New South Wales

- Pinus ponderosa*
- Pinus longifolia*
- Pinus nigra* var. *Poiretiana* (on the higher mountain slopes)
- Pinus radiata* (in the dry interior regions)
- Cedrus deodara*
- Taxodium distichum*
- Cupressus macrocarpa*
- Pseudotsuga taxifolia* (on the higher mountain slopes)

Queensland

- Pinus longifolia*

- *Pinus Montezumae*
- Pinus radiata* (on the highlands of the interior)
- Pinus ponderosa* (on the highlands of the interior)
- Taxodium distichum*

Tasmania

- Pinus radiata*
- Pinus pinaster*
- Pinus ponderosa* var. *Benthamiana*
- Pinus nigra* var. *Poiretiana*
- Cedrus deodara*
- Cedrus atlantica*
- Cupressus macrocarpa*
- Cupressus lusitanica*
- Cupressus torulosa*
- Picea Abies*

New Zealand

- Pinus radiata*
- Pinus nigra* var. *Poiretiana*
- Pinus ponderosa*
- Pinus ponderosa* var. *scopulorum*
- Larix decidua*
- Larix Kaempferi*
- Pseudotsuga taxifolia*
- Cedrus atlantica*
- Cedrus deodara*

South Africa where winter rainfall prevails

- Pinus radiata*
- Pinus pinaster*
- Pinus canariensis*
- Cupressus lusitanica*
- Cupressus macrocarpa*

South Africa where summer rainfall prevails

- Pinus longifolia*
- Pinus ponderosa* var. *arizonica*
- Pinus ponderosa* var. *macrophylla*
- Pinus patula* and other Mexican species
- Cupressus torulosa*

Natal

- Pinus longifolia*
- Pinus palustris*
- Pinus taeda*
- Pinus caribaea*
- Pinus echinata*
- Pinus glabra*

CONCLUSION

SOUTHERN TREES IN NORTHERN LANDS

In bringing this article to a close it may not be out of place to inquire briefly into the value of the trees of the southern hemisphere to the North. At the outset it is well to emphasize that in the North there is little land-surface enjoying a climate favorable to the growth of these trees. None of the softwood trees of the antipodes are ever likely to be of value in forest planting in the northern hemisphere. Fortunately we are well supplied with trees yielding this class of timber and need no help. Several species of the Australian *Callitris* are useful to South Africa but promise nothing for us. Of hardwood trees the species of *Eucalyptus* of Australia are the southern hemisphere's great gift to forestry. Of great value to South Africa they have proved valuable in California, Mexico and some of the countries of western South America and of the Mediterranean Basin. In California many species are cultivated and I believe that some like *Eucalyptus salmonophloia* F. v. Muell. and *E. salubris* F. v. Muell. will be found to be especially useful in the dry southwestern states and in Mexico for forest planting. In parts of south India, especially on the Nilghiri Hills, the common Blue Gum (*E. globulus* Labill.) is now the chief source of fuel. Other species grow well and have a decided future before them in south India and also in the drier northwestern parts of Ceylon. But after all the value of *Eucalyptus* to countries north of the Equator is slight in comparison to what it is in the southern hemisphere where their growth is so extraordinarily rapid. The wood of the different species is of great variety and it seems likely that the genus *Eucalyptus* is destined to supply the bulk of the world's future needs of ordinary hardwood timbers. The ornamental character of a number of species of *Eucalyptus* is considerable and few exotic trees in California are more lovely when in flower than the red-flowered *E. ficifolia* F. v. Muell. of Western Australia. The Blackwood (*Acacia melanoxyylon* R. Br.), indigenous in southeastern Australia and Tasmania, is one of the valuable timber trees of the world. It grows well on the Nilghiri Hills in southern India and on the highlands of equatorial Africa. In these countries it has decided value as a forest tree and very probably there are other countries north of the Equator where it will flourish.

Another useful Australian tree *Grevillea robusta* A. Cunn., is much used for a shade tree over Coffee, Cocoa and other tropical economic crops and is widely planted for ornamental purposes in many warm regions of the earth. The Black and Green Wattles, *Acacia decurrens* Willd., and its variety *mollis* Benth., are of immense importance as a source of tanning material and Natal is now the headquarters of this industry. On the highlands of Kenya Colony in equatorial Africa these Wattles have been largely planted but freights are excessive and Kenya cannot compete with Natal. Coal is not known to occur in Kenya Colony and it had been hoped

that the wood of these Wattles would be valuable as fuel for the locomotives, but the railway grades are steep and the calorific quality of the wood is too low for the intended purpose and the experiment is a failure. On the Nilghiri Hills these Acacias grow freely and so too does the Silver Wattle (*A. dealbata* Link). The latter owing to its suckering proclivities has become a pest though it is serviceable in preventing landslides on railway embankments and dykes. Gardens owe much to Australia for its lovely Acacias. Such species as *A. Baileyana* F. v. Muell., *A. longifolia* Willd., *A. pycnantha* Benth., *A. pubescens* R. Br. and *A. dealbata* Link. being among the choicest trees grown in southern California and in the Mediterranean region. Two Palms, *Howea* (Kentia) *Belmoreana* Becc. and *H. Fosteriana* Becc., indigenous on Lord Howe Island off New South Wales, are indispensable to florists of the North. In South Africa the Western Australian *Acacia saligna* Wendl. with *Pinus pinaster* Ait. has done much towards reclaiming the sandy flats behind Cape Town. The Australian *Albizzia lophantha* Benth. is also a useful plant in northern gardens under glass and so, too, is the Norfolk Island Pine (*Araucaria excelsa* R. Br.). The Bunya Bunya (*A. Bidwillii* Hook.), flourishes near Darjeeling in north India and on the Nilghiri Hills in the south. In Natal these two Araucarias with *A. Cookii* R. Br. and *A. Cunninghamii* Sweet are likely to be of value in forest planting. Curiously enough the Chilean Pine (*A. imbricata* Pavon) does not do well in Australasia nor in South Africa but in Kenya Colony at about 7000 feet altitude the Brazilian species (*A. brasiliensis* A. Rich.) grows faster than any other exotic Conifer. I should think that *Fitzroya patagonica* Hook. f., which is one of the most magnificent timber trees of the temperate regions of South America, would be well worth trying in parts of New Zealand and in southeastern Australia where summer or all the year round rainfall obtains.

None of the South African trees are of any proved value to northern gardens though in California the Silver-tree (*Leucadendron argenteum* R. Br.) and the Cape-chestnut (*Calodendron capense* Thunb.) are occasionally seen. In eastern Australia the latter is one of the favorite exotic flowering trees. The trees of New Zealand are equally unimportant to the North. The Kowhai (*Sophora tetraptera* Ait.) is occasionally grown and some of the Nothofagus are planted in England where their growth in the most favored places is slow compared with that of the South American species. For gardens the only really outstanding New Zealand tree is *Gaya Lyallii* Bak. f. whose masses of pure white flowers are a feature of some of the gardens in favored spots in Great Britain. Two Monocotyledons (*Cordyline australis* Hook. f. and *C. indivisa* Steud.) are most useful garden plants in California, the Mediterranean region and even thrive in Cornwall and in the Scilly Isles. In the southern hemisphere and notably in Australia and South Africa there are a great number of shrubs and small trees of great value to the gardens of warm sunny northern lands but for forest planting very few southern trees are likely to be of value north of the Tropic of Cancer.

GEORGE ROGERS HALL, LOVER OF PLANTS

JAMES M. HOWE, JR.

(The Journal is glad of the opportunity to print this account of the life of Dr. Hall written by his grandson, for little is known at least to this generation of the man who first sent Japanese plants direct to the United States and to whom American gardens owe the introduction of the Japanese Yew, the most valuable plant brought to the United States from Japan, *Malus Halliana Parkmanii*, *Abies homolepis*, *Thujaopsis dolabrata*, *Magnolia stellata* and *Lilium auratum*. To Mr. Howe's paper is added an appendix containing a list of the plants known to have been first introduced into this country by Dr. Hall, and an account of the important collection of trees which he planted on his farm in Bristol, R. I., which now contains the largest specimens in the United States of a few species.—Ed.)

GEORGE ROGERS HALL was born in Bristol, R. I. on March, 1820.

Dr. Hall's farm, which was purchased by his father in 1830 and on which he spent many years of his life, is situated on the westerly side of the main road connecting the towns of Warren and Bristol. It consists of a level area along the road, a rocky slope, and finally more level land extending down to the waters of Narragansett Bay. The situation is an unusually fine one. The old farmhouse, however, is set near the high-road and does not command any special outlook. A lane runs back from the street and continues down to the shore, dividing the farm into two nearly equal parts.

Hall went to Trinity College, Hartford, graduating in 1842, and from there to the Harvard Medical School, matriculating with the class of 1846.

After graduation, young Dr. Hall decided to embark for China, sailing under the auspices of members of the King family of Newport, who seem to have been friends of his father. In China Dr. Hall met Edward Cunningham and David Oakes Clark, both of Milton, Massachusetts, and formed with them the close friendship which lasted all their lives.

Dr. Hall commenced practice in the foreign settlement of Shanghai, built a house there and in the year 1850 came back to America to marry Helen Beal, daughter of Thomas Prince Beal, a lawyer of Kingston, Mass. Mrs. Hall returned with him to his China home. Here three sons were born—Chandler Prince 1851, Edward Cunningham 1853, George Rogers 1854.

Mrs. Hall returned to America with her three small sons in 1854, the youngest, George, falling ill and dying on the voyage. Mrs. Hall's letters, written at this time and during her stay in China, are full of charm and of the warmest affection for the husband whom she was now leaving behind.

Soon after his wife's departure, Dr. Hall gave up the active practice of medicine and joined with his friend, Cunningham, in the more lucrative business of trade. Dr. Hall made a number of voyages on Cunningham's schooner yacht, the *Halcyon*, and on one occasion had a serious brush with pirates, who at that time infested the China seas. A voyage was made to Japan in 1855 before the formal opening of that country to trade.

During this period, Dr. Hall and Mr. Cunningham accumulated a good deal of money, through trade and through certain favorable conditions in regard to the rates of exchange of gold and silver. What was of more interest, however, was the fact that these two men had good taste and their eyes open to the opportunity of collecting some of the finest and rarest of Chinese and Japanese curios, bronzes, lacquer work and ebony. On his several trips to America, Dr. Hall brought back with him, as did Cunningham and Clark, large numbers of now priceless objects of art. Dr. Hall's great interest in horticulture also began to assert itself at this time, and he began to send specimens of plants to America, some of which now bear his name, and others, though probably of his introduction, which are not now credited to him. Unfortunately, Dr. Hall kept no record of his experiences so that little is known of the disposition of his plants. Many were taken by Dr. Hall himself to Bristol and planted there, and to-day form an interesting and unique collection, highly prized by some of the leading plant lovers of the country.

In 1861, or early in 1862 Dr. Hall returned to America and rejoined his family. Twin daughters, Elizabeth and Helen Beal were born at Bristol in 1864 and in the same year the devoted wife died. Dr. Hall made one more trip to Japan in 1875, a previous voyage undertaken with Mrs. Hall, having been given up on account of sickness when the couple reached Aspinwal.

The two sons entered Harvard College. Chandler remained only a year, and then following in his father's footsteps, went to Japan. There he lived the remainder of his life. He died of smallpox in Kobe in 1897. Edward took a prominent place in his class (1876) and became its First Marshall. He showed great interest in athletics, being a member of one of the first football teams which played Yale. After graduation, he went to the West and has remained there ever since, being engaged in cattle ranching. His present location (1923) is near the Missouri River in eastern Montana, some 35 miles from Jordan, Dawson Co., and 130 miles from the railroad at Miles City.

In the sixties, Dr. Hall began to look about for a new place in which to settle in America. He considered California, and Southboro, Mass. Mrs. Hall would have preferred a conventional life in Boston and her husband's return to active practice, but this did not suit him, and no change from Bristol was made, however, until Dr. Hall made his first trip to the south in 1865. He lived for a season or two near Rome, Georgia, but nothing is remembered of this period, save that he was accustomed to hang out the Union flag from his house, only to have it repeatedly torn down. His next move was to Jacksonville, Florida, where he built a house, "Narragansett," here he passed many winters.

Benjamin Hall, his father, died in 1872 and Dr. Hall thus came into possession of the farm at Bristol. The rest of the doctor's life was spent in Bristol and in Florida with the exception of the short trip to Japan in 1875.

Dr. Hall's life was now wrapped up in the care and cultivation of his plants. One of the best fields at Bristol was chosen as a suitable location for the planting of a great evergreen border and here were set out some fifty or more varieties of trees. In the garden back of the house had been planted and still stands the original Japanese Yew—*Taxus cuspidata*. A great collection of trees, shrubs, fruit trees, lilies and perennial plants are dimly remembered by friends who knew the doctor in those days. Of these many have disappeared, but some of the Conifers and a few of the deciduous leaved trees to-day are among the finest specimens of their kind in the country.

In the great border there now remain several large specimens of *Abies firma*, *Abies cilicica*, *Abies cephalonica*, *Picea pungens*, and *Picea polita*. There are a large *Picea jezoensis*, an Umbrella Pine (*Sciadopitys verticillata*) a Thujopsis, several Yews and a fine *Abies homolepis*. There are also a number of handsome specimens of Thuya of different varieties, several dwarf Spruces, Retinosporas in variety and especially Retinospora or *Chamaecyparis obtusa*, which thrives exceedingly and has seeded itself in many places.

In the deciduous section the important tree is *Zelkova serrata*, the Japanese Elm, a magnificent tree thriving exceedingly in this climate, but as yet little known. The delicate arching branches of the Zelkova, its fine, smooth brown bark, and its strong habit of growth should certainly commend it for more general planting. The tree bears heavy crops of seed, which germinate with great readiness, and the ground about the older specimens is generally thickly overgrown with seedlings. Zelkovas planted in Milton by Dr. Hall's daughter and by the author of this article have made rapid and healthy growth.

Another interesting and rare tree planted at Bristol by Dr. Hall is *Phellodendron Lavalleyi*, of which there is but one specimen. The bark, though rough, is less corklike than that of *Phellodendron amurense*, and to the uninitiated the tree might be mistaken for an Ash.

Other more common trees are *Ginkgo biloba*, Maples including the dwarf Japan varieties, the Kentucky Coffee-tree (*Gymnocladus dioeca*), the Gums, (*Liquidambar styraciflua*, and *Nyssa sylvatica*), European Beech (*Fagus sylvatica*), Yellowwood (*Cladrastis lutea*), Honey Locust (*Gleditsia triacanthos*), Horsechestnut (*Aesculus Hippocastanum*) of which there is one showing a variegation in the foliage, Pyramidal Oak (*Quercus robur* var. *fastigiata*), Tulip-tree (*Liriodendron Tulipifera*).

A fine specimen of Hall's Magnolia (*M. stellata rosea*) still remains in a sheltered spot, and is a glory in the early spring with its profuse clothing of long pinkish white and fragrant blossoms.

Hall's Flowering Apple (*Malus Halliana*) often called the Parkman Crab since Dr. Hall sent the first specimens to Mr. Parkman, may still be seen, though there is no longer a good specimen of this tree.

Hall's Honeysuckle (*Lonicera japonica* var. *Halliana*) runs rampant under the trees and has done much harm in the past through climbing

over the Conifers. *Evonymus*, probably *Evonymus patens*, grows freely as a shrub or as a ground cover according to its location in sun or shade, and there is too, a fine hedge of this interesting plant.

Hall's *Amaryllis* (*Lycoris squamigera*) is naturalized in a number of places. This interesting plant sends up in the Spring its long leaves flatly rounded at the ends. Later the foliage disappears and is followed in August by clusters of beautiful, fragrant pink flowers.

In another location on the farm there are several large specimens of the Japanese Walnut (*Juglans Sieboldiana*) producing edible nuts in great round dark cases.

A delicate shrub flowering early in the Spring, *Corylopsis pauciflora* still remains in the old garden of Dr. Hall's house, and there is a hardy Orange (*Poncirus trifoliata*) which occasionally bears fruit. There is also a Loquat. The crowning glory of all, however, is the magnificent great Japanese Yew (*Taxus cuspidata* var. *nana*) which stands in a sheltered spot in the garden. This tree is believed to be the original Japanese Yew brought to America. At the base there is a short trunk twelve inches diameter and from this point the rough-barked branches stretch out like octopus feelers in every direction. The specimen was well clothed throughout until a few years ago when lightening struck a neighboring tree and also killed several branches on one side of the Yew. The heavy crop of bright red berries borne in the fall, when seen against the background of dark evergreen foliage, gives the tree a striking appearance. The hardy qualities of this yew combined with its tolerance for shade are now making it a popular plant for general garden planting.

Dr. Hall's life in Florida cannot be very clearly traced. He spent a number of winters in his Jacksonville house and then became interested in a development scheme at Fort George Island at the mouth of the St. John's River, twenty-six miles below Jacksonville. Here a hotel and four or five cottages were built by Dr. Hall and several associates, and the settlement was run with considerable success for four of five years. Then one of the chief supporters of the scheme dropped out, the hotel burned down just at the time when the insurance had lapsed, a storm destroyed a smaller hotel which the company had erected on the beach, and practically all the money invested was lost. Unfortunately, Dr. Hall had little judgment about financial matters, so that this collapse, combined with an even more foolish venture with a gold mine in Georgia, left him with very scanty funds. To complete the misfortune, his Orange-grove was destroyed by the great freeze of 1880-81 and was a total loss.¹ The farm at Bristol was mortgaged, most of the Florida property was sold, and for the remainder of his life Dr. Hall lived largely on the proceeds of the sale of his valuable Oriental curios. Some of the pieces were bought for the Boston Art Museum and others by private individuals. Fortunately a considerable number were kept and now belong to his daughters.

¹ For a graphic description of the great Florida freeze, see Helen Harcourt's "Florida Fruit, How to Raise Them."

Those who remember Dr. Hall at Fort George describe him as a man of great charm and refinement. His house or rather the single room and ell, which was all that he ever built, was a veritable museum of bronzes, china and curios and was regarded with awe and wonder by those who were privileged to visit it. The grounds were a bower of all sorts of tropical plants, lilies of many kinds flourished, especially in the neighborhood of a little pond at the rear. All this has long since disappeared and the writer in a recent trip to the island could find nothing unusual in the way of plants save a Magnolia-tree of great size and some fine Live Oaks. The house or room, however, remains, though moved from its original location, and now forms part of the dwelling of Mrs. Manning. Two rows of massive Live Oaks, planted across the back of Dr. Hall's place, and extending to the land of neighbors, bear impressive witness to the effect to establish windbreaks for the Orange-groves, and to protect them from the disastrous frosts.

Dr. Hall contemplated at one time setting out an orchard of Chinese Sand Pears at Fort George. Helen Harcourt in her excellent book "Florida Fruits, How to Raise Them" speaks of the great results to be expected from the planting of this fruit in Florida. She also mentions the Satsuma Orange as having been originally planted at Fort George, we may presume by Dr. Hall. This Orange is believed today to have considerable possibilities in the colder sections of Florida. Another introduction of Dr. Hall's was the Celestial Fig, plants of which still thrive in the neighborhood of the house.

Fort George Island is today a beautiful and romantic spot. The land is at a considerable elevation above the water and is partly surrounded by salt marshes. Great Live Oak-trees, intermingled with Cabbage Palmettos, and a few exceptionally large Pines shade the ground. A number of miles of shell road make all parts of the island accessible. Beds of oysters line the shore in some places and there is a fine sand beach. The island is reached by crossing the St. John's River in a small boat from Mayport and landing at the little settlement of Pilot Town.

In spite of misfortune Dr. Hall continued to visit Florida in the winters, his last two trips being to Lake Worth. The writer, a small boy at the time, remembers the doctor at Bristol. At this period he was an old man with pointed white beard and rather a gruff manner. On returning from his morning visit to his garden he was accustomed to have a rose in the corner of his mouth, a habit which the older inhabitants of Fort George also recall. On one occasion a grapefruit or pomello, as Dr. Hall called it, was brought out at Bristol and at another time there was an alligator pear. Neither of these fruits at this time had been generally introduced but the doctor had brought them with him from Florida. Dr. Hall occasionally visited his daughter, Mrs. Howe, at her place Brush Hill in Milton, Mass., and here he came for the last time in the autumn of 1899. On December 24, after a short illness George Rogers Hall, then in his eightieth year passed away.

APPENDIX

PLANTS SENT BY DR. HALL TO THE UNITED STATES

THE time of Dr. Hall's visits to Japan was one of great activity in plant introduction following as it did on the heels the opening of the country to foreign trade. In 1856 von Siebold & Co. of Leyden issued a catalogue offering for sale a great many newly introduced Japanese plants. The Russian botanist, Maximowicz, traveled in Japan from 1859-64, John Gould Veitch was there in 1860 from July until late November and Robert Fortune from October 1860 until the end of the year, and again in 1861 from May until the end of July. These collectors sent a variety of plants to Europe where they were promptly placed in the hands of expert cultivators and by Lindley and other botanists named and recorded in current literature without loss of time. Such favorable circumstances did not attend Dr. Hall's introductions. His first consignment was brought to Boston by Mr. F. Gordon Dexter; it arrived in 1861 and was given to Francis Parkman. The second consignment Dr. Hall brought himself and handed over to the Parson Company at Flushing, Long Island, March 1862. These plants seem to have been obtained mainly if not solely from Japanese gardens and include a number with variegated foliage. Just how many species and varieties of plants Hall introduced will never be accurately known for unfortunately no botanist of the time examined his collections. By diligent search of literature and of the records of the Massachusetts Horticultural Society it has been possible to compile the following list and it seems probable that all the plants named were first introduced into America by Dr. Hall. Also it appears almost certain that such valuable plants as the two *Magnolias* (*Magnolia stellata* and *M. kobus*), Hall's Crabapple (*Malus Halliana* f. *Parkmanii*), his Honeysuckle and its variegated form (*L. japonica* var. *Halliana* and f. *aureo-reticulata*), the evergreen *Evonymus patens*, the popular *Hydrangea paniculata* f. *grandiflora*, *Rhododendron brachycarpum*, *Hypericum patulum*, *Cornus kousa*, the double-flowered *Wistaria floribunda* f. *violaceo-plena* and the bulbous *Lycoris squamigera* were introduced into America by Hall before they were in Europe. The bulbs of *Lilium auratum* sent by Hall were exhibited in flower by Mr. Parkman as a "New Lily" but without a name before the Massachusetts Horticultural Society on July 12, 1862 just ten days after Messrs. Veitch had exhibited this Lily in London and Lindley had given it its name.

PLANTS FIRST SENT TO AMERICA FROM JAPAN IN 1861 BY DR. HALL
AND GIVEN BY MR. F. GORDON DEXTER TO FRANCIS PARKMAN

- Ginkgo biloba f. variegata Carr.
- Thujopsis dolabrata S. & Z.
- Thujopsis dolabrata f. variegata Fort.
- Sciadopitys verticillata f. variegata Gord.
- Cryptomeria japonica f. variegata Hort.
- Chamaecyparis pisifera S. & Z.

Juniperus chinensis f. *japonica* Vilm.
Lilium auratum Lindl.
Lilium speciosum (2 new forms).
Hosta (*Funkia*) *plantaginea* var. *grandiflora* Hort.
Lycoris squamigera Maxim.
Malus Halliana f. *Parkmanii* Rehd.
Wistaria floribunda f. *violaceo-plena* Rehd. & Wils.
Hypericum patulum Thunb.
Cornus kousa f. *variegata* Hort.
Rhododendron brachycarpum D. Don.
Lonicera japonica f. *aureo-reticulata* Nichols.
Hibiscus syriacus (a form having yellow flowers with a purple eye)

PLANTS HANDED OVER BY DR. HALL TO PARSON & CO., FLUSHING, LONG
ISLAND, MARCH 1862.

Taxus cuspidata var. *nana* Rehd.
Pinus densiflora S. & Z. (seeds)
Pinus densiflora f. *aurea* Mayr.
Picea polita Carr.
Picea jezoensis Carr.
Abies firma S. & Z. (seeds)
Sciadopitys verticillata S. & Z. (seeds)
Cryptomeria japonica var. *elegans* Mast.
Chamaecyparis obtusa S. & Z.
Chamaecyparis pisifera (10 garden forms of)
Juniperus procumbens Sieb.
Magnolia kobus DC.
Magnolia stellata Maxim.
Evonymus patens Rehd.
Wistaria floribunda DC. (seeds)
Wistaria floribunda f. *alba* Rehd. & Wils.
Wistaria floribunda f. *variegata* Rehd. & Wils.
Wistaria floribunda var. *macrobotrys* Rehd. & Wils.
Hovenia dulcis Thunb.
Acer palmatum Thunb.
Acer palmatum f. *sanguineum* Carr.
Acer palmatum f. *sanguineum variegatum* Hort.
Acer palmatum f. *ornatum* Carr.
Acer palmatum f. *Frederici-Guilelmi* Carr.
Acer palmatum f. *roseo-marginatum* Schwerin.
Deutzia crenata f. *plena* Rehd.
Hydrangea paniculata f. *grandiflora* Sieb.
Aucuba japonica Thunb. (seeds)
Diervilla japonica f. *alba* Mak.
Diervilla japonica var. *hortensis* Rehd.
Lonicera japonica var. *Halliana* Nichols.

Zelkova serrata (plants & seeds).

Quercus dentata Thunb.

Quercus dentata var. *pinnatifida* Mats.

Castanea crenata S. & Z.

In addition to these we are told (*Horticulturist*, xvii. 186 [1862]) there were some fine new Conifers without a name; fifteen double-flowered Cherries, one with flowers as large as a rose; five new Hibiscus; forty-five Maples, many of them variegated and some of them as drooping in their branches as the Weeping Ash; four new sorts of Diervilla, some with variegated foliage; a variegated *Elaeagnus*; a new *Berberis*; a variegated, a dwarf and a giant Bamboo; seven new Honeysuckles; six new Japanese Lilies; eight new Columbines and other herbaceous plants; six new sorts of Chrysanthemums of superior beauty and a new Fern. Among the seeds were those of the Japanese Persimmon, of a variegated Camphor-tree, of a tree with variegated leaves and growing like the Poplar, of another tree with variegated leaves and yellow Hibiscus-like flowers, of a new Weeping tree with white flowers, of a new Primrose with flowers produced in an upright cluster the shape of a pagoda, and of a large number of other trees and shrubs unlike anything we have here and possessing great beauty. Although no mention is made of it Dr. Hall must have introduced *Phellodendron Lavalleyi* Dode for in his garden at Warren, Rhode Island, there is a large specimen with a trunk $3\frac{1}{2}$ feet in girth.

SOME OF THE TREES IN DR. HALL'S PLANTATION ON HIS FARM IN BRISTOL, RHODE ISLAND

On his estate at Bristol Neck, near Warren, Rhode Island, there are growing some of the oldest and finest Japanese Conifers in the eastern States. Dr. Hall probably planted most of these and other trees in 1872 or later. These measurements were made in September 1919. Among the more noteworthy may be mentioned:—

Taxus cuspidata var. *nana*—26 feet tall and 130 feet around, (probably planted before 1872).

Pinus densiflora—50 feet tall, 6 feet in girth of trunk

Picea jezoensis—65 feet tall, $6\frac{1}{2}$ feet in girth of trunk.

Picea polita—55 feet tall, 4 feet in girth of trunk.

Abies firma—90 feet tall, 7 feet in girth of trunk.

Chamaecyparis obtusa—55 feet tall, 3 feet in girth of trunk.

Zelkova serrata—75 feet tall, 6 feet in girth of trunk.

Phellodendron Lavalleyi—35 feet tall, $3\frac{1}{2}$ feet in girth of trunk.

There is also a healthy specimen of *Abies homolepis* S. & Z. 40 feet tall which was planted at a later date. Of Conifers other than Japanese Dr. Hall's old garden boasts fine specimens of *Picea pungens* Engelm., 85 feet tall, *Abies cephalonica* Link, 85 feet tall, and *Abies cilicica* Carr., also about 80 feet tall.

NOTES ON NORTH AMERICAN TREES, XI¹

C. S. SARGENT

NEW SPECIES OF CRATAEGUS

***Crataegus Stevensiana* (§ *Crus-galli*), n. sp.**

Leaves obovate, rounded at the broad apex, gradually narrowed and cuneate at base, coarsely doubly serrate above the middle with acute teeth, subcoriaceous, dark green and lustrous on the upper surface, dull and paler on the lower surface, 3-4 cm. long and 2-2.5 cm. wide, with a thin midrib and slender obscure primary veins; petioles slender, glabrous, narrow-winged nearly to the middle by the decurrent base of the leaf blade, 7-10 mm. in length; leaves on vigorous leading shoots suborbicular, rounded or minutely pointed at apex, broad-cuneate at base, finely serrate above the middle, 3-3.5 cm. long and wide, their petioles broadly wing-margined at apex, 5-7 mm. in length. Flowers opening about the middle of May, 1.2 cm. in diameter, on slender pedicels in thin-branched glabrous mostly 10-15-flowered corymbs, their bracts and bractlets linear, scarious, caducous; calyx-tube narrow-obconic, glabrous, the lobes gradually narrowed from a wide base, acuminate, coarsely serrate below the middle, glabrous on the outer surface, slightly villose on the inner surface; stamens 10, anthers yellow, styles 2 or 3. Fruit ripening late in September, on slender pedicels, in drooping few-fruited clusters, short-oblong to slightly obovoid, green tinged with red, 5-7 mm. long, 4-5 mm. in diameter; calyx little enlarged, with a wide cavity pointed in the bottom; flesh thin and dry; nutlets 2 or 3, rounded at the ends, only slightly ridged on the back, 4-5 mm. long and 3-4 mm. wide, with a dark hypostyle extending to the middle.

An intricately branched shrub 1.5-3 m. high, with dark slightly scaly bark and slender straight or zigzag glabrous branchlets, chestnut-brown and lustrous during their first and second years, becoming dull gray-brown and armed with numerous stout nearly straight dark chestnut-brown spines 3-5 cm. in length.

KANSAS. Wilson County, thickets along small streams and on rocky hillsides, Neodisha, *E. J. Palmer*, No. 21158, May 5, 1922, Nos. 21562 (type), 21374, May 22, 1922, No. 22042, September 19, 1922.

OKLAHOMA. Greer County, "occasional along creek in the mountains," near Granite, *G. W. Stevens*, No. 2891, October 7, 1913. Kiowa County, among rocks on granite hills, near Snyder, *E. J. Palmer*, No. 12586, July 18, 1917, No. 13075 October 26, 1917.

This Kansas and Oklahoma species appears most closely related to *Crataegus jasperensis* Sarg. of southwestern Missouri from which it differs in its more coriaceous leaves rounded and not pointed at apex, smaller

¹ For part X see vol. III. p. 182.

flowers with 10, not 20 stamens, and smaller fruit which is the smallest of all the described species in the *Crus-galli* group. I take pleasure in joining with this species the name of Mr. G. W., Stevens who first collected it is 1913 during his explorations of the flora of Oklahoma.

***Crataegus franklinensis* (§ *Pruinosae*), n. sp.**

Leaves ovate and rounded or elliptic and cuneate at base, acuminate at apex, slightly lobed above the middle with broad acuminate lobes, sharply doubly serrate often nearly to the base, thin, glabrous, dark yellow green on the upper surface, slightly paler on the lower surface, 4-4.5 cm. long, 2.5-3.5 cm. wide, with a prominent midrib and slender primary veins; petioles slender, occasionally glandular with small scattered glands, glabrous, 2-2.5 cm. in length; leaves on vigorous leading shoots broad-ovate, broad-cuneate to rounded at base, slightly decurrent on the stout petiole, up to 5 cm. long and wide. Flowers opening from the 15th to the 20th of May, about 1.4 cm. in diameter, on slender pedicels, in small compact mostly 5-flowered glabrous corymbs; calyx-tube narrow-obconic, glabrous, the lobes gradually narrowed from a wide base, short, acuminate, entire or furnished with an occasional tooth, glabrous; stamens 5 or 6; anthers pale pink; styles 3-5. Fruit ripening the end of September, slightly obovoid to subglobose, dark red, 8-10 mm. in diameter, the calyx little enlarged, nearly sessile, with a wide deep cavity narrowed and rounded in the bottom; flesh thin and hard; nutlets 3-5, rounded at the ends, rather broader at apex, than at base, prominently ridged on the back, 6-7 mm. long and 4-5 mm. wide, the narrow hypostyle extending to below the middle.

A shrub with several stems, erect gray-green branches, slender nearly straight glabrous branchlets, orange-brown early in their first season, becoming dark chestnut-brown and armed with slender nearly straight spines 2-3 cm. in length.

OHIO. Franklin County, north of Columbus between Flint and Glenmary, *R. E. Horsey*, No. 236 (type), May 18, 1914, September 22, 1914, October 23, 1912.

This plant in general appearance resembles *Crataegus ovatifolia* Sarg. from Coopers Plain, New York, but is distinguished from that species by the absence of the short white hairs on the upper surface of the young leaves. These hairs are not common on the species of the *Pruinosae* but when they do occur furnish one of the best characters for distinguishing the species in early spring. They are found on the young leaves of all the species of the *Silvicolae* (*Medioximae*) which have been examined and furnish with the sessile calyx of the fruit the characters by which the plants of this group can be distinguished from those of the *Pruinosae*. The entire absence of these hairs from the leaves of *Crataegus franklinensis* would place it with the *Pruinosae*, although the fruit with its almost sessile calyx suggests that it might also be placed in the *Silvicolae*.

Crataegus Milleri (§ *Pruinosae*), n. sp.

Leaves ovate, rounded or cuneate at base, acute or acuminate at apex, slightly lobed above the middle with acuminate lobes, and sharply often doubly serrate; tinged with red and roughened above by short white hairs when they unfold, soon glabrous and at maturity thin, bluish green, 3-4 cm. long and 2-2.5 cm. wide, with a slender midrib and primary veins; petioles slender, glandular toward the apex, glabrous, 1.5-2 cm. in length; leaves on vigorous leading shoots ovate, acuminate, rounded at the wide base, more deeply lobed and more coarsely serrate, often 6-9 cm. long and 5.5-6.5 cm. wide, with stout deeply grooved petioles 2.5-3 cm. in length. Flowers opening at the end of May or early in June, about 1.5 cm. in diameter, on slender pedicels in mostly 10-15-flowered broad lax glabrous corymbs, their bracts and bractlets conspicuous, glandular-serrate, soon deciduous; calyx-tube broad-obconic, glabrous, the lobes gradually narrowed from the base, slender, acuminate, entire or obscurely serrate below the middle, glabrous; stamens 7-10; anthers pink to rose color or maroon; styles 3-5. Fruit ripening early in October, on long slender pedicels, obovoid, gradually narrowed from above the middle to the acute base, green and covered with a glaucous bloom, becoming red just before falling, 1.5 cm. long and 8-10 mm. in diameter, the calyx little enlarged, with a short tube, spreading and reflexed lobes and a wide shallow cavity; flesh thin, dry and mealy; nutlets 3-5 rounded at the ends, broader at apex than at base, prominently ridged on the back, about 7 mm. long and 5 or 6 cm. wide, the narrow pale hypostyle extending nearly to the base.

A shrub 3-4 m. high, with thick erect branches and stout slightly zigzag glabrous branchlets dark reddish brown when they first appear, becoming lighter before the end of their first year, and armed with numerous stout nearly straight light chestnut-brown spines 3-6 cm. in length.

PENNSYLVANIA. Erie County, Cliffs of 4-mile Creek, Erie, *R. E. Horsey* and *John Miller*, No. 76, September 23, 1916, *R. E. Horsey*, No. 76, May 29, 1917, *John Miller*, No. 76, June 11, 1917; Kearsarge, *R. E. Horsey* and *John Miller*, Nos. 80 (type), 81, 82, 83, 87, September 24, 1916, May 31, 1919, *John Miller*, Nos. 80, 81, 82, 83, June 11, 1917.

This species is most closely related to *C. ovatifolia* from Cooper's Plains, New York, from which it differs in its more sharply lobed leaves often rounded at base, smaller flowers with entire or nearly entire calyx-lobes, and fruit more gradually narrowed at base. It differs from *C. incisa* Sarg. from Stratford, Connecticut, a species with leaves cuneate at base, about ten stamens and obovoid fruit, in its smaller less deeply lobed leaves covered when they first appear with short white hairs, smaller flowers in more numerous-flowered corymbs and fruit more gradually narrowed at base. In shape the fruit resembles that of *C. levis* Sarg. from Litchfield, Connecticut, but the nutlets are narrower, acute at the ends and less prominently ridged on the back. The leaves of that species

too, are less lobed and the flowers with more glandular-serrate calyx-lobes are larger in few-flowered corymbs.

***Crataegus iterata* (§ *Silvicolae*), nov. nom.**

Crataegus seclusa Sarg. in Bull. N. Y. State Mus. clxvii. 89, September 1913,
not *Crataegus seclusa* Sarg. in Trees and Shrubs, II. 239, August, 1913.

By an oversight the name *seclusa* was unfortunately given by me in 1913 to a *Pruinosae* species from southern Missouri, published in August, and to a *Silvicolae* species from the Hemlock Lake region near Rochester, N. Y., published in September. The new specific name, from *itero*, now proposed for the New York species is in allusion to this repetition of names.

***Crataegus Putnamiana* (§ *Coccineae*), n. sp.**

Leaves ovate, acuminate at apex, cordate or rounded at base, laterally lobed with short acuminate lobes, and sharply doubly serrate to the base with acuminate gland-tipped teeth; when they unfold tinged with red, and covered above by short white caducous hairs, and at maturity thin, glabrous, yellow-green on the upper surface, paler on the lower surface, 5-7 cm. long, and 4-6 cm. wide, and on vigorous leading shoots up to 8 cm. long and 7 cm. wide, with a slender prominent midrib and primary veins; petioles slender, glandular, sparingly villose with short white hairs, becoming glabrous, 2.5-4 cm. in length. Flowers opening from the 10th to the middle of May, about 1.5 cm. in diameter, on slender pedicels in 5 or 6-flowered glabrous corymbs; calyx-tube narrow-obconic, glabrous, the lobes narrow, long-acuminate, laciniately glandular-serrate, glabrous on the outer surface, sparingly villose on the inner surface; stamens 16-20; anthers dark red; styles 4 or 5. Fruit ripening early in October, on elongated pedicels in drooping clusters, depressed-globose, slightly angled, green, turning red, punctate, 1.5 cm. in diameter; calyx enlarged with a wide shallow cavity, broad in the bottom and spreading closely appressed lobes; nutlets 4 or 5, rounded at apex, acute at base, prominently but irregularly ridged on the back, 6 or 7 mm. long, 3 or 4 mm. wide, the narrow brown hypostyle extending to the middle.

A shrub up to 5 m. high, with erect stems covered with light gray bark, and stout glabrous zigzag branchlets light chestnut-brown to olive green when they first appear, chestnut-brown and lustrous in their second year, and armed with stout straight spines 3-3.5 cm. in length

OHIO. Washington County, common near Marietta, *R. E. Horsey*, No. 591 (type), September 27, 1916, May 20, 1917.

Of the *Coccineae* only three species with glabrous corymbs and twenty stamens and red, pink or rose-colored anthers have been described, *C. contigua* Sarg. from Stockbridge, Vermont, *C. magniflora* Sarg. from northern Illinois and Ganonoque, Ontario, and *C. splendida* Sarg. from Sarnia, Ontario. From these species *C. Putnamiana* differs in its cordate leaves with villose petioles, and in its larger depressed-globose fruit, that of the related species being short-oblong to obovoid. I have associated

with this distinct and handsome shrub the name of General Rufus Putnam who in 1788 laid out Marietta, the oldest town in Ohio.

***Crataegus illecebrosa* (§ Coccineae), n. sp.**

Leaves ovate, acuminate at apex, abruptly cuneate or rounded at base, divided usually only above the middle into short acuminate lobes and sharply doubly serrate occasionally to the base with straight acuminate teeth; fully grown when the flowers open and then covered above with short soft hairs and pale and glabrous below, and at maturity thin, yellow-green, glabrous, 6 cm. long and 5 cm. wide, with a thin midrib and primary veins; petioles slender, slightly grooved, glabrous, 2.5–3 cm. in length; leaves on vigorous leading shoots rounded at base, more deeply divided into acuminate lobes, their petioles conspicuously glandular. Flowers opening early in June, on slender glabrous pedicels, in mostly 10–12-flowered globose corymbs; calyx-tube narrow-obconic, glabrous, the lobes separated by wide sinuses, slender, acuminate, irregularly glandular-dentate or entire, glabrous on the outer surface, slightly villose on the inner surface; stamens 20–25; anthers dark rose color or red; styles 3–5. Fruit ripening late in October, obovoid, slightly mammillate at the narrow base, crimson, marked by minute pale dots, 2 cm. long and 1.5 cm. wide, the calyx little enlarged with a narrow deep cavity pointed in the bottom and persistent spreading or erect lobes; flesh thick soft and succulent; nutlets 3–5 rounded at the ends, narrower at base than at apex, rounded and slightly grooved or prominently ridged on the back, 7–8 mm. long and 3–5 mm. wide.

An arborescent shrub about 4 m. high, with ascending branches and slender nearly straight branchlets dark green and marked by numerous pale lenticels when they first appear, becoming light red during their first season and ashy gray the following year and armed with occasional nearly straight slender spines 2.5–3 cm. in length.

ONTARIO. Pastures in heavy clay soil about two miles northeast of Kingston, *J. Dunbar*, Nos. 110 (type), and 102, October 19, 1911, and June, 6, 1912.

This species appears to be most closely related to *C. magniflora* Sarg. from northern Illinois, from which it differs in the soft not rigid hairs on the upper surface of the young leaves which later in the season is not scabrate like that of *C. magniflora*, in the less serrate calyx-lobes, and in the softness of the flesh of the fruit which is unusually succulent in a species of this group.

***Crataegus mansfieldensis* (§ Rotundifoliae), n. sp.**

Leaves ovate, acuminate, rounded or cuneate at base, laterally lobed above the middle with short acuminate lobes, and finely doubly serrate with short glands, covered above with short white hairs and villose below along the midrib and veins, and at maturity thin, dark yellow-green, smooth and glabrous on the upper surface, pale, scabrate and still slightly villose on the lower surface along the thin midrib and slender primary

veins, 5-7 cm. long and 3.5-4.5 cm. wide; petioles slender, villose, 2-3 cm. in length; leaves on vigorous leading shoots ovate, acuminate, rounded cuneate or truncate at base, more deeply lobed with acuminate lobes pointing toward the apex of the leaf, 6.5-8 cm. long and 6-7 cm. wide, with petioles 3.5-4 cm. in length. Flowers opening from the 15th to the 25th of May, about 1.5 cm. in diameter, on long villose pedicels, in wide slightly villose mostly 6- or 7-flowered corymbs; calyx-tube narrow-obconic, glabrous, the lobes generally narrowed from a wide base, acuminate, entire or furnished with occasional teeth toward the apex; stamens 20; anthers white, often tinged with pink; styles 3-5. Fruit ripening in October, on slender drooping pedicels, broad-obovoid, subglobose, dark red, 1-1.2 cm. long and 8-10 mm. in diameter; calyx little enlarged, with a wide deep cavity pointed in the bottom and spreading closely appressed persistent lobes; flesh thin, dry and mealy; nutlets 3 or 5, rounded at the ends, broader at apex than at base, rounded and only slightly ridged on the back, 8 or 9 mm. long and 4 or 5 mm. wide, the narrow dark hypostyle extending nearly to the middle.

A shrub or a tree up to 4 m. in height, with a short trunk covered with ashy gray bark, horizontal and drooping branches, and slender nearly straight branchlets orange-green and slightly villose when they first appear, soon glabrous, light red-brown in their second season, becoming light gray-brown, and armed with occasional slender nearly straight spines 2-3 cm. in length.

OHIO. Richmond County, near Mansfield, *R. E. Horsey*, No. 384, May 21, 1915, September 26, 1915 (type), *Wilkinson and Horsey*, May 21, 1915; *R. E. Horsey*, May 25 and October 1, 1916.

The general appearance of this plant would indicate that it could be well placed with the species of the *Asperifoliae* Group, but the entire absence of depressions on the inner faces of the nutlets on which this Group was established would seem to require another disposition for it. The other group with which it could be put is the *Rotundifoliae*. In this group only five species with villose or pubescent corymbs, 20 stamens and yellow or white anthers have been described. From all of these the Mansfield plant differs in the shape of the leaves which resemble those of *C. asperifolia* Sarg. a species of the *Anomalae*. Of the five species of the *Rotundifoliae* with 20 stamens, yellow or white anthers and pubescent corymbs only *C. Oakesiana* Eggleston from Vermont has obovoid fruit, with soft succulent flesh but this is nearly twice as large as that of the Ohio plant. Mr. Horsey's material is not very good and further study of the tree which are now growing in the Arboretum will perhaps show that this species should be referred to another group.

***Crataegus pagensis* (§ *Intricatae*), n. sp.**

Leaves ovate to slightly obovate or oval, rounded and short-pointed or acute at apex, concave-cuneate at base, occasionally and slightly lobed above the middle and doubly serrate with short broad acute teeth; tinged

with red when they unfold, and slightly villose on the upper side of the midrib early in the season, at maturity thin, glabrous, dark yellow-green on the upper surface, paler on the lower surface, 4-5 cm. long and 3.5-4.5 cm. wide, with a prominent midrib and slender primary veins; petioles slender, wing-margined at apex by the decurrent blade of the leaf, 1-1.5 cm. in length; leaves on vigorous leading shoots ovate to suborbicular, often laterally lobed with acuminate lobes, as seen not more than 4.5 cm. long and 3.5-4 cm. wide. Flowers appearing from the middle to the end of April, about 1.5 cm. in diameter, on slender pedicels in glabrous compact mostly 4- or 5-flowered corymbs, the bracts and bractlets leaf-like, oblong-ovate, acuminate, glandular, early deciduous; calyx-tube broad-obconic, glabrous, the lobes gradually narrowed from a wide base, short, acute, laciniately glandular-serrate, glabrous on the outer surface, sparingly villose on the inner surface; stamens 10; anthers rose-color; styles 3 or 4. Fruit ripening the end of September, on short erect or spreading pedicels, in few-fruited clusters, short-oblong to slightly obovoid, dull orange-brown, about 1 cm. long and broad, the calyx little enlarged with spreading lobes, and a deep cavity pointed in the bottom; flesh very thin and dry; nutlets 3 or 4, gradually narrowed and rounded at the ends, rather broader at base than at apex, only slightly ridged on the back, 7 or 8 mm. long and 5 or 6 mm. wide, the dark conspicuous hypostyle extending for about a third of their length.

A shrub 2-3 m. high, with slender zigzag glabrous branchlets dark chestnut-brown and lustrous when they first appear, becoming dark gray-brown in their second year, and armed with many stout or slender nearly straight spines 2.5-4 cm. in length.

OKLAHOMA. La Flore County, rocky slopes and open hillsides near Page, *E. J. Palmer*, No. 2092, April 25, 1921, No. 20629 (type) and 20630, September 24, 1921, Nos. 20921, 20925, April 25, 1922, Nos. 20941, 20986, 20987, April 28, 1922.

This species most resembles *Crataegus padifolia* Sarg. from Swan, Christian County, Missouri, which differs from it in its long ovate leaves and yellow anthers slightly tinged with pink, and in its smaller subglobose fruit.

***Crataegus Youngii* (§ Microcarpae), n. sp.**

Leaves ovate, cuneate and slightly decurrent on the petiole at base, 3-lobed with acute or acuminate lobes, the terminal lobe often divided into small secondary lobes, remotely crenulate-serrate usually only above the middle, glabrous or early in the season villose along the midrib above, dark yellow on the upper surface, paler on the lower surface, 2.5-3 cm. long and 2-2.5 cm. wide, with a slender midrib and obscure primary veins extending to the point of the lobes and often also to the base of the sinus; petioles slender, 1-2 cm. in length; leaves on leading vigorous shoots obscurely laterally or obscurely 3-lobed, more abruptly cuneate or rounded

at base, up to 5 or 6 cm. long and 5 or 5.5 cm. wide, their petioles stouter, 2.5–3 cm. long. Flowers 8–10 mm. in diameter, opening from the 8th to the 20th of May on long slender pedicels in mostly 20–25-flowered rather open glabrous corymbs; calyx-tube broad-obconic, glabrous, the lobes small, nearly triangular, apiculate, glabrous, reflexed after anthesis; stamens 15–20; anthers pale yellow; styles 3–5, usually reduced to 1 by abortion of all but one carpel, persistent on the fruit. Fruit ripening in October and persistent on the leafless branches at least until the beginning of the new year, globose to subglobose, scarlet, 5–7 mm. in diameter, the calyx persistent or deciduous, closely appressed to the fruit or raised on a short neck, with enlarged spreading lobes; flesh thin, yellow, dry and mealy; nutlets often reduced to one by abortion, rounded and broader at the apex than at the acute base, rounded and only slightly ridged on the back, distinctly concave on the inner faces, about 4 mm. long and 2 mm. wide, the narrow pale hypostyle extending nearly to the middle.

A tree 8–10 m. high with a tall trunk covered with dark scaly bark, spreading branches forming a wide symmetrical head, and slender nearly straight glabrous branchlets pale green when they first appear, becoming light chestnut-brown before the end of their first season and dark gray-brown the following year and armed with numerous straight slender spines 2–3 cm. in length.

NORTH CAROLINA. Guilford County, low wet bottoms, near Greensboro, Robert C. Young, April and May 8, 1921, T. G. Harbison, No. 6110, May 9, 1922, Nos. 6028, 6028a (type), May 23, Oct. 9, 1922. Wake County, near Raleigh, T. G. Harbison, No. 6038, Oct. 8, 1922.

SOUTH CAROLINA. Kershaw County, banks of the Wateree River, near Camden, Susan Delano McKelvey, Dec. 26, 1922, T. G. Harbison (No. 6129), May 23, 1922, Nos. 625 and 628, Oct. 6, 1922.

This is one of the most interesting species of *Crataegus* which has been discovered recently in the United States. Its relationship is with the Washington Thorn (*C. Phaenopyrum* Medicus) which it resembles in its small flowers and fruit, in the fact that the primary veins of the leaves extend to the sinuses of the leaves as well as to the points of the lobes, in the style persistent on the fruit, and in the general habit of the tree. It differs from that species in its normally acutely 3-lobed leaves, cuneate and decurrent at base on the petiole, not cordate and not rounded except on vigorous shoots. In *Crataegus Phaenopyrum* the calyx is deciduous from the fruit by a circumsissile line and in falling leaves the top of the nutlets exposed, a character which has not been noticed in any other species of the genus. On the fruit of *Crataegus Youngii* the line of separation can often be distinguished but the calyx is usually persistent and if it does fall the end of the nutlets does not become exposed. The nutlets of the new species are narrower and more concave on the inner face, with a less conspicuous hypostyle. From the other *Microcarpae* it differs in its yellow anthers. The nearly constant abortion of all but one carpel

in the specimens examined is unusual and probably not a constant character.

Crataegus Youngii, so far as now known, is confined to the Piedmont region and the Atlantic coastal plain, while *C. Phaenopyrum*, although it has become sparingly naturalized from cultivation in eastern Pennsylvania and northern Delaware, is a tree of the Mississippi valley, in which it grows from western North Carolina at altitudes of about 700 metres to middle Tennessee, southern Kentucky, and in southern Illinois and southern Missouri, and is now often naturalized in the Ohio valley states.

NEW SPECIES, VARIETIES AND COMBINATIONS FROM THE HERBARIUM AND THE COLLECTIONS OF THE ARNOLD ARBORETUM.

ALFRED REHDER

Cephalotaxus drupacea var. *nana*, comb. nov.

C. nana Nakai in Tokyo Bot. Mag. xxxiii. 193 (1919).

C. nana var. *adstringens* Nakai, l. c.

JAPAN. Hokkaido. Ishikari province: Sapporo, Y. Tokubuchi, April 1887, July 1888, May 1890; same locality, C. S. Sargent, September 17, 1892; Nopporo Forest, E. H. Wilson, No. 7274, July 27, 1914 and No. 7408, August 10, 1914, T. Nakai, August 1919. Siribeshi province: Takashima, J. Matsumura (ex Nakai). Hondo. Aidzu province: Inashiro, T. Nakai (ex Nakai, var. *adstringens*).

CULTIVATED: Arnold Arboretum, October 14, 1922 (plants raised from seed [No 7588] collected by E. H. Wilson at North Kadoma, foot of Hayachine-san, Rikuchu province, northern Hondo).

As *Cephalotaxus nana* Nakai does not differ from typical *C. drupacea* Siebold & Zuccarini except in its habit, it should be considered only a variety of the latter species. Its relation to the typical form is about the same as that of *Torreya nucifera* var. *radicans* Nakai (Tokyo Bot. Mag. xxxiii. 194 [1919]) to the typical *T. nucifera* Sieb. & Zucc. Nakai's variety *adstringens* does not seem to be a very marked variety; it is said to differ in the adstringent taste and in the brownish color of the fruit from typical *C. nana*. *Cephalotaxus drupacea nana* is a low shrub not exceeding 2.5 m. in height with a creeping root-stock producing at intervals upright shoots which flower and fruit when about 1 m. tall. The young plants growing in the Arboretum appear to preserve the habit of the variety.

Taxus media (*T. baccata* × *cuspidata*), hybr. nov.

Intermediate between the parents; as the type may be taken the plant mentioned below which forms a broadly-pyramidal bush with spreading branches and which probably will grow into a tree. Mature branchlets olive-green or slightly reddish above, somewhat darker the second year, later becoming more or less brown; winter-buds oblong-ovoid, obtuse, with obtuse slightly keeled scales; leaves spreading in two ranks, straight

or slightly falcate, 1-3 cm. long and about 3 mm. broad, abruptly contracted into a mucronate point, with a prominent midrib above and rather lustrous, beneath with broad grayish green bands; petiole reddish, decurrent into the rather abruptly enlarged leaf-cushion. Flowers and fruits not seen.

SPECIMENS EXAMINED. Hort. Walter Hunnewell, Wellesley, Massachusetts, *T. D. Hatfield*, March 18, 1923 (from plant figured by T. D. Hatfield in *Garden Mag.* xxxiii, 25, as "English Yew", type Arnold Arboretum, under No. 11270, October 21, 1922 (plant received from Wellesley).

As the two parent species cannot be separated by strong morphological characters it is even more difficult to point out good characters to distinguish the hybrid, the differences become really apparent only by comparison with living plants of the two parent species. From *T. baccata* L. the hybrid may be distinguished by the darker olive-green, often slightly reddish color of the branchlets, not light or yellowish green as in that species, by the keeled scales of the winter-buds, by the stouter and broader, more abruptly acuminate leaves with a more prominent midrib above and by the abrupt enlargement of the leaf-cushion into the petiole. From *T. cuspidata* it differs chiefly in the olive-green color of the branchlets, not brown the second season as in that species, at least on the more vigorous branchlets, in the obtuse winter-buds with obtuse scales, in the leaves spreading distinctly in two ranks and rather lustrous above. This hybrid was raised by Mr. T. D. Hatfield about 20 years ago together with other forms between different varieties of the parent species which combine the characters of the parents in various degrees. An illustrated article giving a record of his observations was published in 1921 by Mr. Hatfield in vol. xxxiii of the *Garden Magazine* (pp. 23-26). One of the forms seems worthy of a distinct name and may be called:

***Taxus media* f. *Hatfieldii*, forma nova.**

Compact shrub of conical outline with upright and ascending branches; winter-buds acutish, with obtuse to acutish slightly keeled scales; leaves radially arranged, straight, 1.5-2.5 cm. long and about 3 mm. broad, rather abruptly pointed, somewhat lustrous above and with a prominent midrib, petiole abruptly enlarged into the leaf-cushion.

SPECIMENS EXAMINED. Hort. Walter Hunnewell, Wellesley, Massachusetts, *T. D. Hatfield*, March 18, 1923 (from plant figured by T. D. Hatfield in *Garden Mag.* xxxiii, 25 as "Irish Yew").

This form, which is probably a hybrid between *T. cuspidata* and the Irish Yew, *T. baccata* var. *fastigiata* Loud., is particularly valuable for its formal habit and may take, together with the following form, the place of the Irish Yew which is not hardy in the neighborhood of Boston while the forms of *T. media* are perfectly hardy here and probably even farther north.

***Taxus media* f. *Hicksii*, comb. nov.**

T. cuspidata *Hicksii* H. & A.

Shrub with upright and ascending branches forming a columnar bush; winter-buds oblong-conic with obtuse slightly keeled scales; leaves mostly

radially spreading, 1.5–2.3 cm. long and slightly over 2 mm broad, those of the leading shoots more gradually pointed, those of the weaker branchlets abruptly pointed, dark green with a prominent midrib above, grayish green beneath. Aril of fruit with narrow opening; seed ovoid, pointed about 6 mm. long, with usually 2 stronger and 1 or 2 weaker ridges at the apex and with an irregularly shaped obtusely 3 or sometimes 4-angled hilum at base.

SPECIMENS EXAMINED: Arnold Arboretum under No. 8036, September 28, 1922 (plants received from the Hicks Nursery, Westbury, Long Island, in 1921 as *T. cuspidata Hicksii*).

This form which differs from the preceeding in its columnar outline was raised by Mr. H. Hicks from seed of *T. cuspidata* f. *nana* Rehd. collected in Mr. C. A. Dana's garden at Dosoris, Long Island, about 20 years ago. The original plant in the Hicks Nursery at Westbury, Long Island, is now about 1.75 m. tall. Young plants raised from cuttings of the original plant have been growing in the Arnold Arboretum since 1921 and have proved perfectly hardy.

Abies Nordmanniana f. *tortifolia*, forma nova.

A typo recedit foliis falcatis ramulum versus incurvis cincinnatis.

SPECIMENS EXAMINED: Hort. Mrs. William Bayard Cuttery, Oakdale, Long Island, New York, *W. C. Knight*, No. 4, November 5, 1920 and October 14, 1922 (branches with cones).

Instead of having the leaves fairly uniformly pointed forward as in the type the leaves are strongly falcate and curved inward making the arrangement of the leaves appear curly and very irregular. The tree is vigorous and healthy with leaves 2.5–3 cm. long.

Picea Abies f. *argentea*, comb. nov.

Abies excelsa argentea Berg in Schrift. Naturf. Ges. Univ. Dorpat, II. 39 (Ein. Spielart. Fichte) (1887).

Picea excelsa argentea Hort. apud Beissner, Handb. Nadelholzk. 367 (1891).—Schroeter in Ber. Schweiz. Bot. Ges. X. 133 (1900), as *lusus*.

Of the origin of this form which has the leaves variegated with white I have been unable to find any record.

Picea Abies f. *mucronata*, comb. nov.

Abies communis mucronata Loudon in Gardeners' Mag. n. ser. VII. 386 (1841).

Abies excelsa 12. *mucronata* Hort. apud Loudon, Encycl. Trees & Shrubs, 1027 (1842).—Gordon, Pinetum, 5 (1858).

Abies mucronata Rauch ex Gordon, l. c. (1858) as *synon.*, not Rafinesque.

Pinus Picea var. *mucronata* Endl. apud Lawson, List Pl. Fir Tribe, 18 (1851).

Picea excelsa mucronata Carrière, Traité Conif. 247 (1855).—Sénéclauze, Conif. 28 (1867).—Beissner, Handb. Nadelholzk. 366 (1891).—Hornibrook, Dwarf Conif. 114 (1923).

This form was raised by Briot at the Trianon gardens near Versailles, France, where it was seen by Loudon in 1840 and described one year later. It is a strong growing shrub forming a wide pyramid with ascending or sometimes spreading branches, with stout reddish yellow branchlets

and with rather distant dark green stiff and sharply pointed leaves 0.8–2 cm. long.

***Picea Abies* f. *columnaris*, comb. nov.**

Abies excelsa var. *columnaris* Jacques in Ann. Soc. Hort. Paris, XLIV. 653 (1853).
Picea excelsa columnaris Carrière, Traité Conif. 248 (1855).—Boehm in Zeitschr. Forst. Jagdwes. XXV. 228, fig. 4 (1895), as var.—Conwentz in Abh. Landesk. Prov. Westpreuss. IX. 158 (1895), as forma;—Schroeter in Vierteljahrsschr. Naturf. Ges. Zuerich, XLIII. 173, 233, fig. 19–21 (1898), as *lusus*; in Ber. Schweiz. Bot. Ges. XIII. 109, fig. 4 (1903).—Badoux, Beaux Arbres Cant. Vaud, 40, fig. (1910), as *lusus*.

P. excelsa var. *pyramidalis* subvar. *columnaris* Schneider in Silva Tarouca, Uns. Freiland-Nadelhoelz. 230, fig. 122 (1913).

This form is a tree with short nearly horizontally spreading much ramified branchlets of nearly equal length giving to the tree a narrow cylindric or columnar shape. It was first described by Jacques, who observed it in cultivation in the nursery of Cochet, at Suimes near Brie Comte Robert (Seine-et-Marne), France; it also has been found growing spontaneously with the type in a few localities in Switzerland and Germany.

***Picea Abies* f. *cupressina*, comb. nov.**

P. excelsa lus *cupressina* Thomas in Mitt. Deutsch. Dendr. Ges. XVI. 252, pl. 8 (1909).—Schelle, Winterh. Nadelhoelz. Mitteleur. 82 (1909).

P. excelsa var. *pyramidalis* subvar. *cupressina* Schneider in Silva Tarouca, Uns. Freiland-Nadelhoelz. 230 (1913).

This form is a tree with ascending branches furnished chiefly toward the end with crowded rather short branchlets forming a very compact columnar head rounded at the apex. This rounded apex is the chief difference between this form and *P. Abies* f. *pyramidata* (Carr.) Rehd. which also is a narrow almost fastigiate tree, but of more conical outline and distinctly pointed at the apex. *Picea Abies* f. *cupressina* was discovered by Professor Dr. Thomas in Tambach, Thuringia, Germany, and first described in 1907. The tree has been propagated by grafting and a young plant obtained in 1910 from A. H. Hesse in Weener is growing in this Arboretum.

***Picea Abies* f. *Veitchii*, comb. nov.**

P. excelsa Gregoriana forma *Veitchii* Hornibrook, Dwarf Conif. 97 (1923).

Mr. Hornibrook states that this was sent out about 25 years ago by Veitch as var. *Gregoriana* together with the true var. *Gregoriana* from which it differs in its more vigorous habit forming a larger, less compact and broader conical bush, in its longer branchlets inclined to droop and in its leaves being radial in arrangement and stiff and needle-shaped only on the leading shoots, thinner and flatter and semi-radial or nearly pectinate on the lateral branchlets.

***Picea Abies* f. *Parsonsii*, comb. nov.**

P. excelsa Gregoriana forma *Parsonsii* Hornibrook, Dwarf Conif. 98 (1923).

According to Mr. Hornibrook this form was sent out by S. B. Parsons of Flushing, New York, as var. *Clanbrasiliana*. It is similar to *P. Abies*

f. *Gregoryana* Nash (*Abies excelsa* var. *Gregoryana* Gord.), but differs in its more horizontally spreading branches and pendulous branchlets, forming a looser and straggling bush, in its longer branchlets and longer, flatter, rather distant leaves not radially arranged.

***Picea Abies* f. *erythrocarpa*, comb. nov.**

P. excelsa var. *erythrocarpa* Purkyne in Allg. Forst. & Jagdzeit. LIII. 1, tab. (1877).—Willkomm, Forstl. Fl. ed. 2, 74 (1877).—Voss, Vilmorin's Blumen-gaert. i. 1241 (1895), as forma.

P. vulgaris var. *erythrocarpa* Jacobasch in Sitzber. Bot. Ver. Prov. Brandenb. XXIV. 98 (1882).—Beck, Fl. Nieder-Oester. 7 (1890).

P. excelsa a. *vulgaris* f. *erythrocarpa* Wittrock apud Schroeter in Vierteljahrschr. Naturf. Ges. Zuerich, XLIII. 250 (1898).

Pinus Abies f. *erythrocarpa* Voss in Putlitz & Meyer, Landlex. iv. 770 (1913).

According to the color of the young cones two forms can be distinguished, one with green cones f. *chlorocarpa* (Purk.) Th. Fries, and one with violet-purple cones, f. *erythrocarpa*. Both forms are found throughout the range of the species and it seems impossible to determine which of the two should be considered the type of the species, therefore both names must be considered of equal standing.

× ***Populus canadensis* Moench, Verz. Bäume & Sträuch. Weissenstein, 81 (1785).—Ascherson, Fl. Prov. Brandenb. I. 646 (1864).—Koehne, Deutsch. Dendr. 81 (1893).—Mathieu, Fl. Forest. 495 (1897).—Ascherson & Graebner, Syn. Mitteleur. Fl. IV. 34 (1908).**

? *P. helvetica* Poederle, Man. de l'Arb. II. 148 (1792).

P. latifolia Moench, Méth. 338 (1794).

P. nigra v. *P. helvetica* Poirlet, Encycl. Méth. v. 234 (1804).

P. deltoidea Schneider, Ill. Handb. Laubholz. i. 7, fig. 1 d-f, 3 o-p, 9 g-m (1904), non Marshall.

P. pseudocanadensis Schneider, l. c. 8 (1904).

Moench's *Populus canadensis* is apparently the oldest name for the hybrid between *P. nigra* L. and *P. balsamifera* L. (*P. deltoidea* Marsh.).¹ Though the original description is very meagre, the chief character, the absence of the glands at the base of the blade given by Moench to distinguish *P. canadensis* from *P. carolinensis* (*P. balsamifera* L.) is precisely the character by which the leaves of this hybrid differ from those of *P. balsamifera*. A number of varieties more or less differing in minor characters have arisen in cultivation.

× ***P. canadensis* var. *serotina*, comb. nov.**

P. serotina Hartig, Naturgesch. Forstl. Culturpfl. 437 (1851).—Henry in Elwes & Henry, Trees Great Brit. Irel. VII. 1816, t. 409, fig. 16 (1913).

P. angulata a. *serotina* Dippel, Handb. Laubholz. II. 202 (1892).—Koehne, Deutsch. Dendr. 82 (1893).

This variety which seems to have originated in France about the middle of the eighteenth century is probably the type of *P. canadensis*. It is

¹ Henry (in Elwes & Henry, Trees Great Brit. Irel. VII. 1807, footnote) says that the identity of *P. canadensis* Moench is doubtful and that it is possibly the same as *P. angulata* Aiton, but the fact that Moench particularly emphasizes its hardness as compared with his *P. heterophylla* which he describes as tender, does not sustain Henry's suggestion. I am, however, inclined to believe that Moench's *P. heterophylla* which certainly is not *P. heterophylla* L. is identical with *P. angulata* Ait.

known only in its staminate form. To this variety belong the two following forms:—

× *P. canadensis* var. *serotina* f. *erecta*, comb. nov.

- P. monilifera erecta* Selys-Longchamps in Bull. Soc. Bot. Belg. II. 11, 13 (1864).
P. canadensis b. *erecta* Dippel, Handb. Laubholz. II. 200 (1892), excl. syn. of Carrière.
P. deltoidea f. *erecta* Schneider, Ill. Handb. Laubholz. I. 7 (1904), excl. syn. of Carrière.
P. serotina var. *erecta* Henry in Elwes & Henry, Trees Great Brit. Irel. VII. 1817 t. 385 (1913).

A form with ascending branches forming a rather narrow pyramidal tree.

× *P. canadensis* var. *serotina* f. *aurea*, comb. nov.

- P. canadensis aurea* van Geerti André in Ill. Hort. XXIII. 26, t. 232 (1876).
P. canadensis d. *aurea* van Geert apud Dippel, Handb. Laubholz. II. 200 (1892).
P. serotina var. *aurea* Henry in Elwes & Henry, Trees Great Brit. Irel. VII. 1817 (1913).

A form with yellow leaves.

× *P. canadensis* var. *regenerata*, comb. nov.

- "Peuplier regeneré" Carrière in Rev. Hort. 1865, 58, 276.
P. canadensis f. *grandifolia* h. bot. apud Dieck, Nachtr. Haupt-Verz. Zoeschen, 1887, 16, nomen nudum.
P. canadensis regenerata Hort. ex Schelle in Beissner, Schelle & Zabel, Handb. Laubholz-Ben. 16 (1903) as synonym.
P. regenerata Hort. ex Schneider, Ill. Handb. Laubholz. I. 7 (1904), as synonym. of *P. deltoidea*.—Henry in Elwes & Henry, Trees Great Brit. Irel. VII. 1824 (1913).

This variety originated according to Carrière near Paris in 1814. It is very similar to the preceding variety, but unfolds its leaves about a fortnight earlier and is known only in the pistillate form.

× *P. canadensis* var. *marilandica*, comb. nov.

- P. marilandica* Bosc apud Poirét, Encycl. Méth. Suppl. IV. 378 (1816)—Henry in Elwes & Henry, Trees Great Brit. Irel. VII. 1828, t. 409, f. 19 (1913).
P. canadensis Hartig, Naturgesch. Forstl. Culturpfl. 436 (1851).
P. euxydon Dode in Mém. Soc. Hist. Nat. Autun, XVIII. 41. 69 (Extr. Mon. Populus) (1905).

This variety the history of which is unknown has probably the same origin as var. *serotina*. It is a less vigorous tree of more spreading habit and resembles more *P. nigra* than its American parent, while var. *serotina* and var. *regenerata* are nearer the latter.

× *P. canadensis* var. *Eugenei* hort. Simon-Louis frères apud Schelle in Beissner, Schelle & Zabel, Handb. Laubholz-Ben. 16 (1903).

- "Peuplier Eugène" Carrière in Rev. Hort. 1865, 58.
P. Eugenei Simon-Louis ex K. Koch, Dendr. II. 1, 493 (1872), pro forma *P. canadensis*.—Mathieu in Gartenfl. XXXVI. 675 (1887), sine descript.—Schneider, Ill. Handb. I. 9, (1904).—Sargent in Trees & Shrubs, II. 212 (1913).—Henry in Elwes & Henry, Trees Great Brit. & Irel. VII. 1826, f. 409 f. 17 (1913).

P. pyramidalis meetensis Mathieu in Gartenfl. xxxvi. 674 (1887), pro synon.
P. Eugenei.

? *P. Charkoviensis* Schroeder in Moeller's Deutsch. Gaert.-Zeit. xviii. 393, fig. (1902).

P. Canadensis × *nigra* B. *Eugenei* Ascherson & Graebner, Syn. Mitteleur. Fl. iv. 45 (1908).

This is supposed to be a hybrid between *P. canadensis* and *P. nigra* var. *italica* and originated in the nursery of Simon-Louis at Plantières near Metz in 1832. It approaches the Lombardy Poplar in its smaller leave smore cuneate at the base and in the narrow pyramidal habit. It is the Carolina Poplar of American gardens.

To this group of hybrids (*P. balsamifera* × *nigra*) apparently belong also *P. Lloydii* Henry and *P. Henryana*, *P. Krauseana*, and *P. ramulosa* Dode. More information about the different forms mentioned above will be found in Elwes & Henry, Trees Great Brit. & Irel. VII. 1814-1831.

× **Ribes Knightii** (*R. divaricatum* × *Lobbii*), nom. nov.

Ribes divaricatum × *Lobbi* J. K. Henry in Canad. Field-Nat. xxxiii. 94 (1920).

Upright shrub; young branchlets puberulous, glabrous and yellowish gray the second year; spines stout, simple or 3-parted, 0.8-1.5 cm. long, light brown, lustrous. Leaves suborbicular in outline, deeply 3-lobed or sometimes 5-lobed, 2-3.5 cm. across, with obtuse crenate-dentate or lobulate lobes, dull green above and slightly pilose or nearly glabrous at maturity, sparingly villose beneath, more densely so on the veins, glandular when young; petioles 1-2.5 cm. long, thinly villose and slightly stipitate-glandular, setose toward the base. Flowers with the leaves, 8-10 mm. long, 1-3 on a peduncle 4-8 mm. long; pedicels 2-4 mm. long, glabrous or nearly so like the peduncle; calyx-tube campanulate, about 3 mm. long, greenish outside and loosely villose like the sepals, the latter oblong, dark red, more than twice as long as the calyx-tube, reflexed; ovary densely stipitate-glandular; petals broadly cuneate-spatulate, 3 mm. long, white or pinkish at the truncate apex, stamens about as long as sepals with oval, green anthers. Fruit sparingly developed, subglobose, about 1 cm. across, claret-red, glandular-setose, crowned by the persistent calyx.

SPECIMENS EXAMINED: Hort. George Fraser, Ucluelet, Vancouver, British Columbia, G. Fraser, 1920 (flowers), July 27, 1922 (fruit).

This handsome hybrid was found by Mr. George H. Knight of Mount Tolmie Nursery, Victoria, British Columbia, growing among the parents, *R. divaricatum* Dougl. and *R. Lobbii* Gray, at Mill Hill, Vancouver Island. It was removed to his nursery and propagated and cuttings sent to Mr. G. Fraser from whom we received our specimens. It was first described by Professor J. K. Henry (l. c.) and its intermediate character clearly set forth by him, though he expresses some slight doubt in regard to the hybrid character of the plant, saying that in the genus spontaneous hybrids between wild species are unknown in North America and that hybrids are produced with difficulties by the horticulturist. His first statement is apparently true and seems to apply not only to American but also Old

World species, but in regard to the second statement I may point to the fact that Janczewski in his monograph of the genus and in the supplements to it describes more than 25 different hybrids, many of them having originated spontaneously in gardens.

Cotoneaster Franchetii Bois var. **cinerascens**, var. nov.

A typo recedit praecipue habitu robustiore foliis majoribus ad 4 cm. longis plerisque elliptico-ovatis et acuminatis saepius diametro majore infra medium, subtus laxius villosa-tomentosis colore vix albido sed cinereo vel virescente, corymbis in apice ramulorum elongatorum ad 5 cm. longis multifloris.

SPECIMENS EXAMINED: Weed Landscape Nursery, Beaverton, Oregon, *H. E. Weed*, June 1922 and September 20, 1921 (received as *Cotoneaster* sp. Schneider No. 309 from the Arnold Arboretum).

This variety looks at first glance very distinct from typical *C. Franchetii* and bears some resemblance in its more vigorous upright habit and in the larger usually acuminate leaves less densely tomentose and less white on their under surface to *C. foveolata* Rehd. & Wils., but in flower and fruit it agrees exactly with typical *C. Franchetii* except that the inflorescence is generally larger and borne on longer branchlets. It was raised at the Arnold Arboretum from seed received in 1915 from Mr. C. Schneider under No. 309 collected in Yunnan or southwestern Szechuan; the plants did not prove very hardy in this Arboretum and did not reach sufficient size to flower but plants sent to Oregon are growing well as the flowering and fruiting specimens which we have received show. Among Schneider's herbarium material of *C. Franchetii* of which we have Nos. 1761 and 3415 from Yunnan and 3491 from southern Szechuan there is no specimen which agrees with the new variety.

Pyracantha crenulata var. **kansuensis**, var. nov.

A typo recedit praecipue foliis minoribus supra medium tantum sparsius crenato-serrulatis, corymbis sub fructu leviter adpresse villosulis, fructibus minoribus depresso-subglobosis.—Folia anguste oblonga vel oblanceolata, apice rotundata, obtusa vel interdum acutiuscula, 1–2.5 cm. longa et 4–8 mm. lata, minora elliptica vel anguste elliptica, 6–10 mm. longa; petioli 0.5–2 mm. longi, glabri; corymbi vix 2 cm. diam., fructus 3–5 gerentes (sed in speciminibus spontaneis ut videtur majores et pluriflori); fructus circiter 5 mm. diam., scarlatini.

CHINA. Kansu, near Yan-pu-ko, *F. N. Meyer*, No. 1784 (S. P. I. No. 40736) October 6, 1914.

CULTIVATED: plants raised from seed distributed by the Dept. of Agriculture under No. 40736: Arnold Arboretum, *A. Rehder*, October 2, 1917 (sterile); Chico, Seed and Plant Introduction Station, *Peter Bisset*, September 14, 1919 (sterile); Santa Barbara, *E. O. Orpet*, November 29, 1922 (type).

This variety seems nearest to *P. crenulata* var. *Rogersiana* A. B. Jacks., but differs from it and from the type chiefly in the pubescent corymb, a character by which it approaches *P. coccinea* Roem., but that species has larger acute more sharply serrulate leaves of different shape, slenderer

pubescent petioles and often a slight pubescence on the midrib beneath, and larger fruit. Meyer's original specimens are unfortunately in such a bad state of preservation that it did not seem wise to take them as the type of this form particularly as the pubescence of the corymb is no longer recognizable on that fragmentary material.

***Malus yunnanensis* var. *Veitchii*, var. nov.**

Pyrus Veitchii Hort. in Gard. Chron. ser. 3, LII. 288 (1912), nomen.—Veitch, Cat. New Hardy Pl. China, Autumn 1913, 12.

Pyrus yunnanensis Bean in Bot. Mag. cxli. t. 8629 (1915), in part, and as to plant figured.

Malus yunnanensis Rehder in Sargent, Pl. Wilson. II. 287 (1915), in part, as to the Hupeh plant.

A typo recedit foliis fere omnibus distinctius lobulatis lobulis breviter acuminatis vel acuminulatis basi magis cordatis autumnno subtus glabrescentibus fructibus intense rubris albo-maculatis laevibus.

CHINA. Hupeh: Fang Hsien, woods alt. 1600–2300 m., *E. H. Wilson*, No. 2994, May 19, 1907; without precise locality, *E. H. Wilson*, Veitch Exp. No. 670. Eastern Szechuan: Wushan Hsien, *A. Henry*, No. 5638.

CULTIVATED: Arnold Arboretum, May 26, 1914, October 3, 1918, May 26, 1922; Kew Arboretum, May, 1914, September 28, 1922.

This variety differs from the type in the generally larger ovate leaves all or nearly all distinctly lobulate with short-acuminate lobules becoming glabrescent in autumn and in the more brightly colored smooth fruit, while in the typical form the leaves are ovate to oblong-ovate, less often cordate at base, partly or mostly without any trace of lobules or less deeply lobulate, more densely tomentose beneath with more persistent tomentum; the inflorescence is usually smaller, more compact and more densely tomentose and the fruit is verruculose and of duller color. As in some other species of wider distribution in central China the plants from Hupeh and eastern Szechuan, east of the Red Basin, though conspecific differ more or less from those from western Szechuan, west of the Red Basin. In the herbarium these differences are often not so pronounced and may escape notice, but when both forms are in cultivation and can be seen growing side by side the differences are becoming more apparent. The variety was introduced by *E. H. Wilson* for Veitch in 1901 and in 1907 a plant was received from the Veitchian nurseries at this Arboretum. The type originally described from Yunnan was found in 1908 by *E. H. Wilson* in western Szechuan and seeds sent by him to this Arboretum were received in February, 1909. Both forms have proved hardy at the Arnold Arboretum and have grown into handsome pyramidal trees; as an ornamental plant the variety is to be preferred on account of its more brightly colored fruit.

× ***Acer zoeschense* f. *elongatum*, comb. nov.**

Acer neglectum elongatum Schwerin in Mitt. Deutsch Dendr. Ges. xx. 423 (1911).

As *Acer neglectum* Lange is preoccupied by *A. neglectum* Hoffmannsegg the name *A. zoeschense* Pax will be the next oldest name for the hybrid

between *A. campestre* and *A. Lobelii*. The form *elongatum* differs from the type chiefly in its deeply 3-lobed leaves with elongated lobes undulate at the margin and often lobulate, the middle lobe ovate to ovate-oblong usually narrowed at the base and the lateral lobes often with a larger lobe on their lower side, and in the red color of their veins beneath and the petiole.

(*To be continued*)